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RAPID TRANSIT IN NEW YORK.

We give below engravings illustrative of the elevated and of the underground systems of city travel. The former, under the auspices of the New York Elevated Railway, has lately been extended, and is now running in this city, with a single track, on Greenwich street and Ninth avenue, from the Battery to Central Park, a distance of five miles, being the first considerable portion of any purely local line for rapid transit that has, up to the present time, been constructed in this city. We also present, on other pages, sectional views of this work, together with other drawings pertaining to the above subject matter.

The question of rapid transit in New York has for a long period perplexed our citizens, has had a curious history, and is finally nearing a curious solution. Public opinion as to the particular system or form of transit best suited to meet the wants of our community has, from time to time, greatly varied. Twenty-five years ago the elevated railway plan was chiefly favored. That was a time when money was scarce; people felt poor, and wanted a cheap form of railway, quickly built. Various forms of these structures were engraved and discussed in the SCIENTIFIC AMERICAN at that period, but none were adopted.

As the times improved and money became more plentiful, the underground railway, with its solid tracks, superior speed, and unlimited scope for public accommodation, became the favorite, and the bare suggestion of filling our streets with elevated railways was hooted at and set aside.

Underground roads were, by the press and engineers, declared to be the only proper and adequate means for rapid transit, and charters therefor were now granted. Among these grants was that for an underground railway, directly beneath Broadway, the finest street in the world and (by reason of its large local population, central position, and celebrity) regarded by many as the best of all railway routes. One of our engravings illustrates the character of the stations designed for this railway. The street pavement is to be supported upon iron girders and ornamental columns, with masonry arches between the beams. The entire line of works, from the Battery to Central Park and Grand Central Depot, is designed to be of the most substantial and enduring character. The general plan of the works will be similar to the underground railways of London, which now ramify in all directions throughout that great metropolis, are constantly being extended, and have been proved, by years of experience, to furnish the only positive means of fast city travel worthy of the name of rapid transit.

Another of the charters granted was for the existing Fourth Avenue Underground Railway, details of which were fully illustrated in our paper a few months ago. This great work was completed last year at a cost of six millions of dollars, of which three millions or more were furnished from the city treasury. The line extends northerly from 42d street to Harlem river, a distance of four miles and a half. Over the four tracks of this underground railway the immense traffic of the New York Central and Hudson River Railway, the New York and Harlem, and the New York, New Haven, and Hartford, and their many branches is now conducted with such regularity, safety, and comparative silence that the fact of the working of these roads within the heart of the city is almost forgotten by the majority of people. When these roads were worked above ground, the columns of our local newspapers contained frequent and bitter complaints against them.

The financial revulsion of 1873, the effects of which still prevail, made our citizens again feel poor, and revived the cry for cheaper plans of transit, on the elevated system. Last year the legislature created a board of five commissioners to determine routes and authorize certain lines of these bridges, if they thought best. They have reported in favor of them; their report is now before the courts, and will, it is expected, soon be confirmed; in which case our citizens will probably have an extended experience

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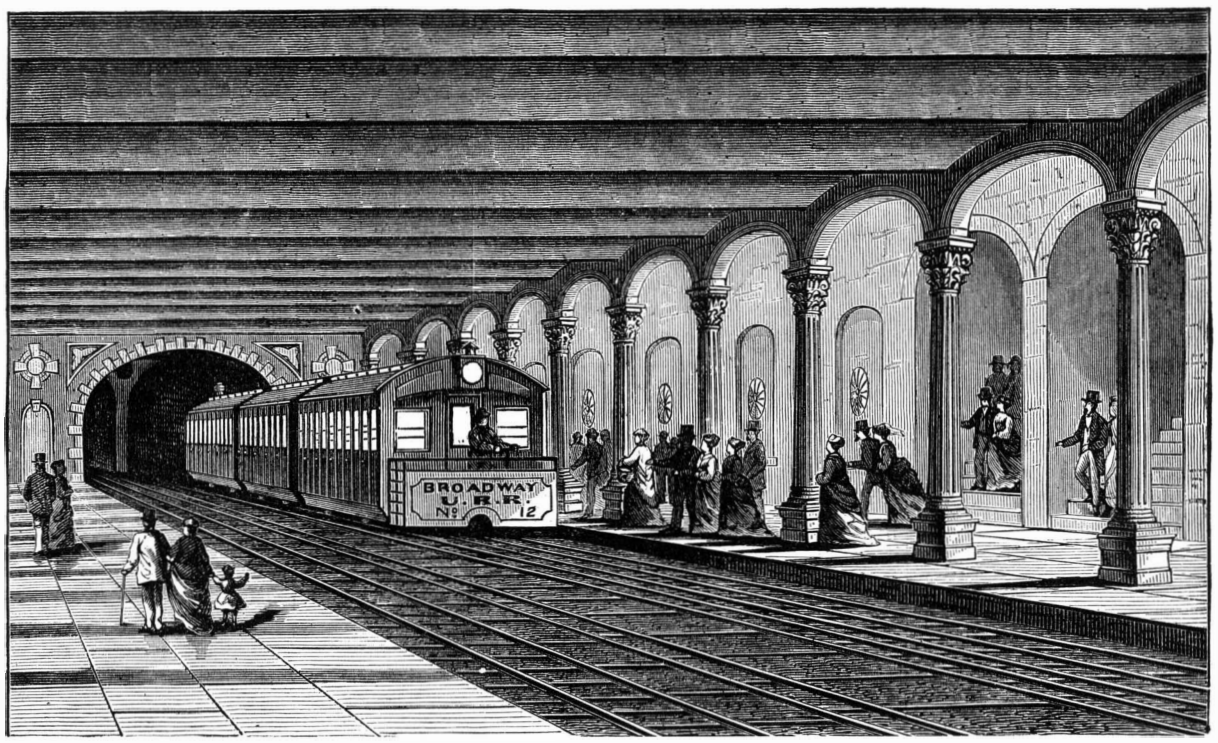
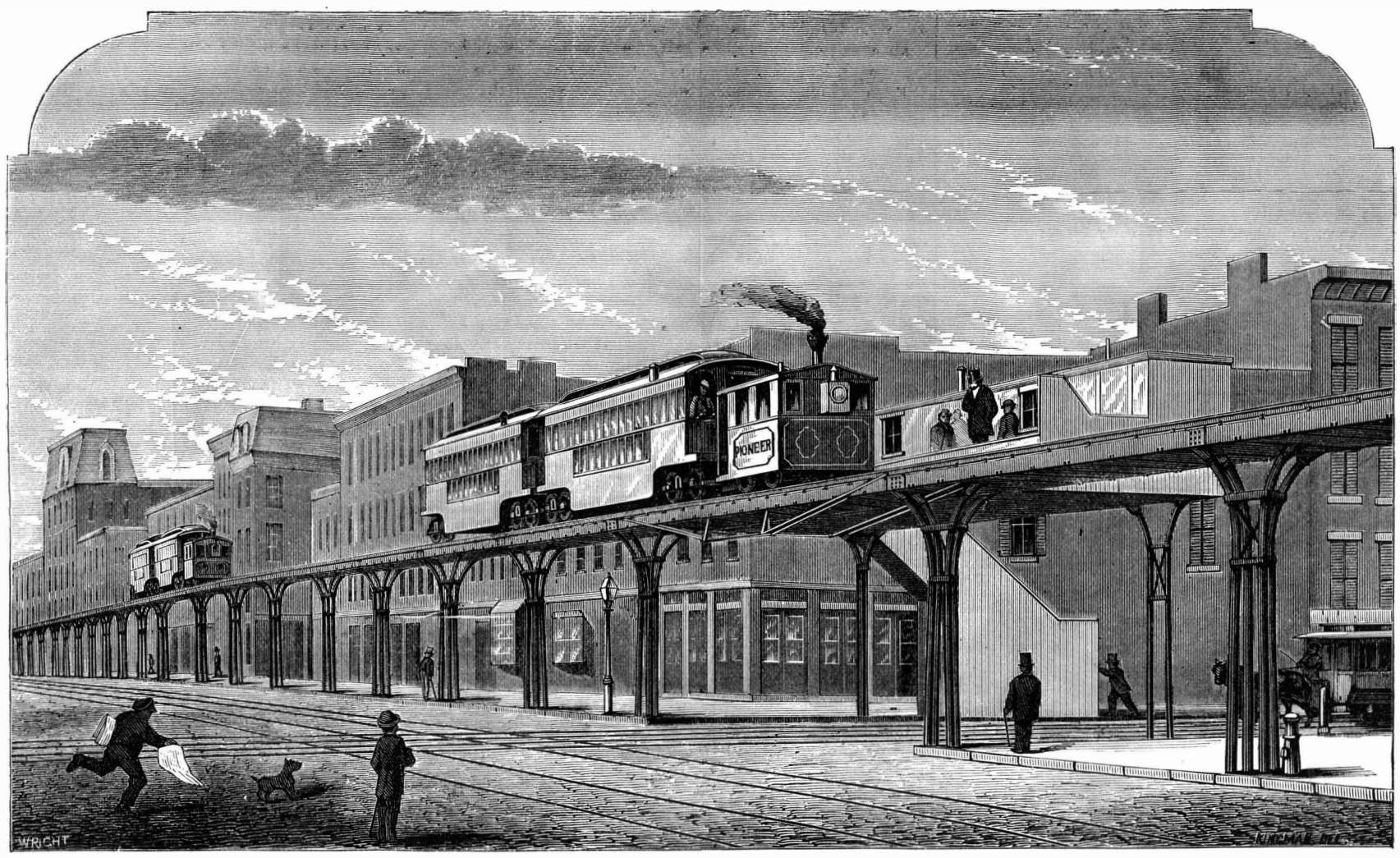


GENERAL DESIGN FOR STATIONS.—BROADWAY UNDERGROUND RAILWAY.



NEW YORK ELEVATED RAILWAY—SINGLE TRACK—GREENWICH STREET AND NINTH AVENUE, NEW YORK.

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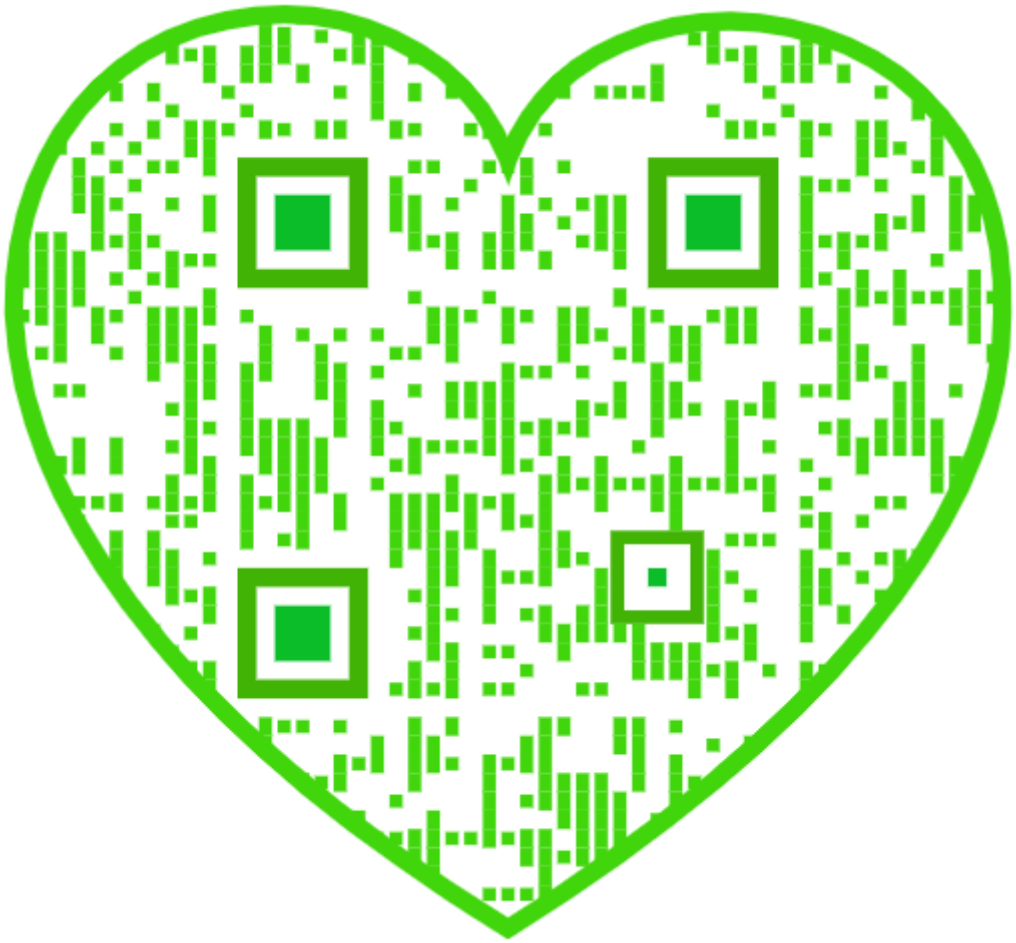

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NEW YORK, SATURDAY, APRIL 1, 1876.

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Milking Cows.

The milk of cows soon after they have calved contains more butter, and is much more easily churned. than it is afterwards. About five months after calving the milk undergoes a change, and the cream is not only less in quantity, but the butter globules are smaller. The reason why milk froths in churns is that, when it sours, alcohol is formed by the decomposition of the sugar of milk, and this causes the milk, when shaken or beaten, to foam or froth. If this froth exists to a large extent, butter will not come, and the milk is useless for churning purposes. The longer a cow is milked after calving, the less is the yield of butter, and the less nourishment is there contained in her milk.—*Land and Water.*

A BIT OF ANCIENT TRAVEL.

In our description of the Oera Linda alphabet (page 195 of our last issue), mention was made of the circumstance that among the many internal evidences of the genuineness of the Oera Linda manuscript was an account of a visit to the pile dwellers of the Alpine lakes, which could not have been written by any one in recent times. It is certain that the manuscript has been in the Oera Linda family for several generations, and equally certain that previous to 1853, when the first remains of pile dwellings were accidentally discovered, the existence of a people living in that way had been forgotten for a period of two thousand years. It rests with those who question the antiquity of the record to show how the following narrative, not to mention others, could have been invented at any time since the extermination of the lake men and the destruction of their remarkable settlements, of which the historians of Southern Europe make no mention.

The first and most ancient account of the pile dwellers is also the most complete and circumstantial. It occurs in the story of Apollonia, chief priestess or burgtmaagd of a place called Lindasburgt, which she describes at length, furnishing a remarkable picture of a civilization in Europe more ancient than that of Greece. Her visit to the pile dwellers was made about the middle of the sixth century before the birth of Christ. It was the rule among the ancient Frisians that, before a burgtmaagd could enter upon the duties of the office to which she had been elected, she must travel for a year. Upon her devolved the responsibility of teaching the maidens how to set to work when they went among the people, and naturally it was essential that she should be well acquainted with the country. It was during her tour of observation that Apollonia visited the pile dwellers.

"My journey," she writes, "was along the Rhine, on this side going up and on the other down. The higher I went, the poorer the people seemed to be. Everywhere about the Rhine the people dug holes, and the sand that was got out was poured with water over fleeces to get the gold; but the girls did not wear golden crowns of it. Formerly they were more numerous; but since we lost Schoonland (Scandinavia) they have gone up the mountains. There they dig ore and make iron. Above the Rhine, among the mountains, I have seen Marsaten. The Marsaten are people who live on the lakes. Their houses are built upon piles, for protection from the wild beasts and wicked people. There are wolves, bears, and horrible lions. Then come the Swetsar (Swiss), the nearest to the frontiers of the distant Krekalanders (Italian and Greeks), the followers of Kalta (Kelts), and the savage Twiskar (Germans), all greedy for robbery and booty. The Marsaten gain their livelihood by fishing and hunting. The skins are sewn together by the women, and prepared with birch bark. The small skins are as soft as a woman's skin. The burgtmaagd at Fryasburgt (Freiburg) told us that they were good, simple people; but if I had not heard her speak of them first, I should have thought they were not Frya's people (that is, white men), they looked so impudent. Their wool and herbs are bought by the Rhine people and taken to foreign countries by the ship captains. Along the other side of the Rhine, it was just the same as at Lydasburgt (Leyden). There was a great river or lake, and upon this lake also there were people living upon piles. But they were not Frya's people: they were black and brown men who had been employed as rowers to bring home the men who had been making foreign voyages, and they had to stay there till the fleet came home."

About two centuries and a half after Apollonia's visit, her descendant, Konerêd, added to the family record a history of Friso and his son Adel, in which another visit to the pile dwellers is mentioned. Hitherto Friso has been supposed to have been the founder of the Frisian race; but it appears that he only brought back to the ancient home of his family a colony of Frieslanders whose ancestors had traveled to the Far East about sixteen centuries before Christ, at a time when there was unbroken water communication between the Mediterranean and the Red Seas. The subsequent closing of the channel by an uplifting of the present isthmus during an earthquake is graphically described in the writings of Adela. Friso had been in the service of Alexander the Great, having built the conqueror's fleet on the Indus and brought it, under Nearchus, by way of the Red Sea to the Isthmus of Suez, over which the ships were drawn to the Mediterranean. He afterwards returned to Friesland with his followers, and was elected grevetman of the districts round Staveren.

When Friso's son Adel had finished his studies at the citadel of Texland, he was sent to travel through the States, accompanied by his wife Ifkja, a clever Frisian: this some time about the middle of the third century B. C., at which time the pile dwellers still inhabited the lakes among the mountains. Adel and his wife spent some time among them, not without great apprehension, for the plundering Twisklanders (Germans) were pressing hard upon them. On the return toward the lowlands, four servants of the party, who had loitered a little, were set upon and murdered by Twisklanders, who are described as banished and fugitive whites who had taken wives from among the Tartars, so called because they made war on everybody. They were all horsemen and bloodthirsty robbers, calling themselves Frijen or Franken. Hitherto the settlements on the Alpine lakes have been known only through their remains. The Paeonians, who inhabited Lake Prasias, as described by Herodotus (book V., chapter 16), were undoubtedly a branch of the same race; and his account tallies well not only with those of Adel and Konerêd Oera Linda, but also with the deductions of archæology. Herodotus, however, knew nothing of the existence of such a people so far to the west; consequently these descriptions, by contemporary writers so many centuries ago, are as valuable as they are interesting.

We may add that tribes living in a similar manner have been discovered in New Guinea, and very recently (by Lieutenant Cameron) in Central Africa.

THE NAVAL ENGINEER CORPS.

Many of our readers may not be aware that the usefulness of the United States Naval Academy at Annapolis has within the past few years been greatly extended by the addition of a thoroughly scientific and practical course of mechanical and marine engineering, and that the engineer corps of the navy is now mainly recruited from the graduates of the institution. The course of study for the cadet engineers comprises four academic years, during which time they are thoroughly instructed in designing, drawing, fabricating, and operating steam machinery, in mathematics, natural philosophy, and the English branches. Their physical culture is carefully attended to, the studies being varied by gymnastic exercises and infantry and artillery drills. The rank, pay, and position of the cadet engineers is the same as that of the cadet midshipmen, their courses of study being parallel. They are, however, appointed in a different manner. The cadet midshipmen, as is well known, are appointed on the nomination of senators and members of Congress. The cadet engineers are appointed from those passing the best competitive examinations. The positions are thus thrown open to those who can show themselves to be the best qualified to fill them, which is just as it should be.

Twenty-five appointments are allowed by law each year, and they are made in September, at the commencement of the academic year. The examination for entrance begins on September 5 next; and those wishing permits to be examined should apply soon to the Secretary of the Navy or the engineer in chief, by mail, for blank applications and pamphlets, containing full particulars as to the qualifications of candidates and the nature of the examination they are required to pass. Candidates must be from 16 to 20 years of age, and must have a fair education. They must send to the navy department, with their applications, certificates as to their good health and character, the dates of their birth, and information as to the educational advantages hitherto enjoyed. Candidates who receive permission must go to Annapolis at their own expense, and, if successful, must furnish themselves with an outfit of uniforms, clothing, and books, at a cost of $230. After admission to the Academy, the salary of the cadet is sufficient for all his necessary expenses, and he will receive from the government a thorough education at an institution which the last report of the Secretary of the Navy declares to be a "school of mechanical and marine engineering second to none in the world;" and on finally graduating he will be commissioned an assistant engineer in the navy.

THE SCIENCE OF CURRENCY.

A proposition has been sent to the Committee on Banking and Currency of the House of Representatives, suggesting that a committee of scientific experts be appointed, to enquire whether there is any science of money and currency, and if they find there is, to express the laws briefly and clearly; but if it shall appear that no such science is known, they shall endeavor to "evolve, discover, or create" such a science. Probably this plan will excite a general smile, for it is very hard to find a person who does not think that he knows all about such matters, and is only surprised that there are so many foolish people who will not agree with him. In spite of all this, however, it is impossible to resist the conviction that we are continually approaching the time when the affairs of this world will be conducted on scientific, that is, on common sense, principles. A good many persons are accustomed to think of scientists as theoretical dreamers, whose labors are of little or no practical importance; but no idea could be farther from the truth. A scientific man is one who is endeavoring to discover Nature's laws, and publish them for the guidance of mankind. The scientists hows us how to make the most of the resources placed at our disposal, how to increase the yield of our land, to reclaim deserts, to harness the physical forces, to avoid disease, to live more comfortably and securely.

In this country, we find ourselves at the present time in the hight of a conflict relating to the currency, and it seems to be entirely overlooked that the elaborate argumenst *pro* and *con* lack even the merit of originality, as they have been uttered scores of times in bygone years, and can be exhumed from the literature and official records of foreign countries. This sort of repetition becomes monotonous, after a while, to say nothing of the disastrous effects of an unsettled policy on the business interests of a country. Now that demagogues have had their say, it is time to call for the views of Science; and we hope the proposition will receive due consideration.

MILK AND ITS ADULTERATION.

When doctors disagree, who shall decide? New York city has been greatly exercised lately by a renewal of the discussion about the methods of detecting the fraudulent adulteration of milk. It was long since settled that water was the only substance employed for adulterating milk, and the question is narrowed down to the determination of the quantity of water added to this popular beverage. Dr. C. F. Chandler has appeared as the champion of the much abused lactometer, and Dr. R. O. Doremus as its chief opponent. The courts lean first one way and then the other, and the public are left as much in the fog as ever.

The question excites much interest, although, aside from its moral and economical aspect, it really does not deserve much attention Of course such a systematic course of

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fraud as that which takes $4,000,000 per annum from honest citizens to pay for water mixed with milk, should not be tolerated. Yet if the milkmen will put clean pure water in their milk, we suffer no injury except to our pockets. In truth the excess of water is the least disagreeable distinction between the milk delivered at our doors and that enjoyed by the rural swain. The hot jolt over stony roads, exposed to the sun's direct rays, as it wends its way to the station, where it waits a few hours for the night milk train, to say nothing of the trip on the rail, enable it to reach us just before it begins to sour, but in a fit state to undergo that change at once on taking it from the ice box. It has spent from 12 to 18 hours in a can none too clean at the start, and soon begins to reproduce for us the well known odor of a dirty milk can. The empty can is returned unwashed on the following day to the honest farmer, whose industrious wife finds it impossible, by careful scalding and scouring, to make it perfectly clean and sweet before it must start off again, and probably consolos herself with the thought that it is "good enough for New Yorkers." To our minds and palates, the filth and stench introduced into it in other ways, including the food of the cow, etc., are far more objectionable and dangerous than the water about which so much stir is being made just now. There is a simple mode of escape from all these by the practice of a little self-denial, by learning to drink black coffee and clear tea. Or, if this task prove too difficult, three or four condensed milk companies stand ready to furnish us and our babies with a pure article of acknowledged healthfulness.

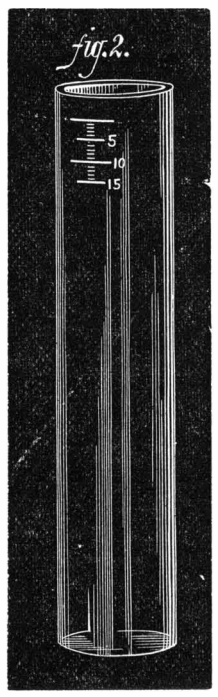
But what are the difficulties in the way of detecting watered milk? Milk is itself a dilute aqueous solution of milk sugar, caseine, and small quantities of mineral salts, and holds in suspension a quantity of fat in a fine state of division. Its composition, when taken from the cow, varies considerably, being richer in the morning than at night, that which is drawn last from the udder, called strippings, being richer than that drawn previously. The same cow yields richer milk when well fed than when poorly fed; and town-fed milk differs from country-fed milk. It is likewise affected by the age of the calf, breed of the cow, etc. The amount of water in unadulterated milk varies from 81·47 to 90·7 per cent, the average according to Letheby being 86·0 per cent. The amount of fat or butter globules varies even more, ranging from 1·79 to 9·88 per cent, both of these figures representing extreme and very uncommon cases. Caseine varies less, from 2·43 to 5·37; sugar, from 3·29 to 6·56; salts, 0·50 to 1·15. Two of the leading English chemists put the average composition of pure milk as follows:

	Letheby.	Wanklyn. Town.	Wanklyn. Country.
Water	86·00	85.94	87·55
Fat	3·90	4·00	3·08
Caseine	4·10	5·02	4·04
Milk sugar	5·20	4·31	4·62
Ash	0·80	0·73	0·71
	100·00	100·00	100·00

It will be evident that, if a complete analysis of a given sample of milk be made, it will tell us neither how much water has been added nor how much cream has been removed. The dairyman must have the benefit of the doubt, and the law should permit him to furnish as poor milk as the poorest cows will give on fair food, and hence he is permitted and encouraged to dilute his best milk down to this standard, no matter what method of testing be employed.

A word about testing milk may not be out of place here. The most satisfactory test is, of course, complete chemical analysis; but unfortunately, the time required precludes its use, except to prove a point already indicated by some more rapid method. If it were possible to erect a huge chemical laboratory at every railroad depot, and employ an army of skilled chemists to analyze a specimen from every can of milk, the time required would be such that most of the milk would sour before it reached the consumers' hands. Beside, it is probably not the farmers but the middlemen who dilute it. The course of analysis is briefly this: A weighed quantity of milk is evaporated to dryness on a water bath, dried at 212°, and weighed; the loss represents the water, and should not exceed 88 per cent. This residue is treated with ether (which dissolves out the fat), is filtered, the filtrate evaporated to dryness, and weighed; the result equals the butter. The total residue, *minus* the butter, is a tolerably constant quantity, and should be about 9 per cent. The caseine in cow's milk (not in breast milk) may be coagulated and determined thus, and the salts are determined by burning off the combustible portion of the solid residue after extracting the butter.

The lactometer, about which we hear so much said, is simply a very delicate hydrometer (Fig. 1), so arranged that it floats in pure water at the zero point of the scale. The depth to which it sinks in milk or other liquid having a specific gravity of 1·029 at 60° Fah. is marked 100°. It is not claimed for this instrument that it is able to do more than show the specific gravity of the liquid. This form of instrument was devised by Dinocourt, and was employed for a long time in Paris and London, where its imperfections and careless use brought severe censure upon it. The difficulty in judging of the quality of milk when we know its density consists in this: Milk contains two different kinds of ingredients, salt and sugar, each of which increases its specific gravity; and butter or cream, which lowers its specific gravity. Hence the apparent paradox that you may lower the specific gravity of the milk by adding either water or cream, and increase its density by removing the cream. Although cream is lighter than milk, it is heavier than water; and hence the addition of cream has much less effect than an equal amount of water; so that although this lactometer does not detect skimmed milk, it does detect the admixture of any considerable amount of water. It was necessary to put the standard of pure milk as low as that of the poorest pure milk to avoid injustice to honest dealers; and for this purpose many hundred samples of pure milk, direct from the cow, were tested, and none being found lower than 1·029, this was taken as the 100° mark for pure milk. Milk that has a greater density may have been skimmed or even slightly watered; if the density is less than that, it is due to one of two things, either water or cream has been added; as no man will add the latter, it is a safe supposition that it is due to the former. Granting the possibility of a farmer or dairyman owning one cow, whose milk is so unusually rich that it falls below 100° on account of cream, he is not likely to send her milk to market or if he does, when mixed, as it must be, with other milk, it will be lifted to the standard at least. So that while the lactometer does not decide the absolute value of the milk, it serves to indicate any considerable amount of dilution; and whether followed up by a complete analysis or not, it will not injure the seller, although affording partial protection to the buyer. The fact that its use by the Board of Health has seriously interfered with the dishonest profits of the milkmen is quite evident from their vigorous efforts to prevent its use. It is not, however, true, as many seem to think, that all milk which stands above 100° is allowed to pass by the sanitary police. Should the milk be wanting in cream, as is easily told by the appearance of the lactometer when it is lifted from the milk, a sample is taken and carefully analyzed to determine the amount of cream removed, a point which, as we have seen, the lactometer does not settle. Several other tests have been suggested for determining the relative value of milk. Each of these is open to one of two objections: they either require delicate balances and skilled fingers, or give very rough approximations. A very simple instrument, which may be used in connection with a lactometer, is known as the creamometer, Fig. 2. It is a straight tube, closed at the bottom and graduated



in hundredths, although the graduation need extend but a little way from the top down. The milk is poured in and allowed to stand and throw up its cream; the volume is then read. Pure milk yields about 10 per cent of cream, but is subject to great variation, so that, while this instrument determines the richness of the milk with some accuracy, and would at once detect skimmed milk, it is unable to decide how much water has been added, because unwatered milk may still be poor in cream, and watered milk throws up its cream more rapidly than pure. John Horsley, F.C.S., modifies this test as follows: One tablespoonful or half an ounce of milk is poured into a tube 11 inches long and ¾ of an inch in diameter, graduated from 10 inches down into hundredths. An equal bulk of ether is next poured in, and the tube closed and shaken for five minutes. An equal measure of alcohol is then added, and again shaken for another five minutes. On placing it upright, the oily matter rises to the surface. Each line of oil corresponds to 4·15 grains of solid butter, and milk with 10 per cent of cream will show two lines of oil, or 8·3 grains for 250 grains of milk.

Sacc's method, which is similar to Horsley's, consists in mixing the milk with an equal volume of alcohol (70° Tr.), and shaking. In good milk the coagulum should occupy the same volume as the milk did. If the coagulum remains suspended in the liquid instead of rising quickly to the surface, it is a proof that water has been added.

Still another method has been devised, depending on the opacity imparted by the butter globules, but space forbids our entering into a minute description of it.

The butter and caseine may best be determined by coagulating the milk with a few drops of acetic acid, boiling, washing the precipitate with water, and finally separating the butter with ether, leaving the caseine pure. On evaporating the ether, the butter extracted by it is left and may also be weighed. No chemist would, of course, attempt to deduce the weight of this coagulum from its bulk, which depends entirely on its compactness, and, although apparently simple, is actually a very fallacious test.

Boussingault has shown (Dingler's *Polytechnisches Journal*, CCV., 65) that the microscope readily distinguishes good milk from skimmed or watered milk; but the microscope, like the balance, is a costly piece of apparatus and reliable only in skilled hands.

TO THE FRIENDS AND PATRONS OF THE SCIENTIFIC AMERICAN.

At no period since the commencement of the publication of this paper—thirty years ago—has its regular weekly circulation been so great as it is at present. This fact is gratifying to us, and not less so, we are sure, to our advertising patrons. Notwithstanding the hard times, scarcity of money, and depression in most kinds of manufacturing business, our old subscribers have never renewed their subscriptions more promptly; and never before have so many new names been enrolled in our subscription books as have come in since the commencement of the new volume. The success of the SCIENTIFIC AMERICAN SUPPLEMENT has exceeded our expectations; and, although but three months old, it has obtained, we believe, a larger circulation than that of any similar publication in this country or Europe, while that of the regular edition of the SCIENTIFIC AMERICAN is undoubtedly greater than the *combined* circulation of all the papers of its kind published both in this country and Europe.

These papers go into most of the manufacturing establishments and machine and workshops of this country, and are on file in the principal libraries and reading rooms in the United States and Europe, thereby affording an unequaled medium for manufacturers of all kinds of machinery, and vendors of any new mechanical articles, new inventions, patents, etc., to advertise their wares. Through no other source can they reach the class of persons most likely to become their patrons.

Every established business firm knows the necessity of advertising; therefore a hint to them is not needed. But upon persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or to find a manufacturer to work it—upon this class we would impress the importance of advertising; and we believe there is no other source from which the advertiser can get as speedy returns as from the columns of the SCIENTIFIC AMERICAN and its SUPPLEMENT.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business. All who advertise persistently, and through such mediums as have the largest circulation among the class of persons most likely to be interested in the articles offered, advertise judiciously. That the SCIENTIFIC AMERICAN and the SUPPLEMENT go into the manufacturing establishments, and are taken by persons interested in all kinds of engineering and mechanical enterprises, no one will deny; but what the extent of circulation necessary to reach all these classes of persons is, few stop to realize, and none but the publishers and their advertising patrons, we suppose, care much about it. But the latter are interested in this matter; and for their information we would state that 47,500 copies of the SCIENTIFIC AMERICAN and 15,000 of the SCIENTIFIC AMERICAN SUPPLEMENT are printed every week, making a total aggregate on both editions of 62,500 copies of each issue. Of this large edition, in no single week since the 1st of March have we failed to distribute a less quantity than 60,000 copies to our regular subscribers in this country and abroad, through the mails and newsdealers; and we are happy to say that the demand increases each successive week.

We thank our friends and patrons for their liberal encouragement; and we shall strive to render to all classes of them—subscribers, advertisers, and inventors—a full equivalent for their money.

THE FATHER OF WATERS.

Under this head we recently called attention to the remarkable paper of J. B. Eads, C.E., published in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 11, reviewing the labors of the United States Levee Commission, pointing out a number of most serious errors, as he conceives, in the conclusions reached by the Commission. The area of reclamation was given by us at 70,000 square miles, but should have been given at 30,000 square miles. The area of the valley drained by the Mississippi is estimated to contain an aggregate of 1,200,000 square miles, and to be capable of supporting a population of over 300,000,000. In our SUPPLEMENT for the present week (No. 14) Brevet Brigadier General Abbot criticises Engineer Eads' review, giving diagrams of the soundings of the river, showing the accumulation of sediment on the bottom, resulting from increased river volume, with other facts that look difficult of explanation on the theory of Captain Eads. The discussion is one of interest and importance.

Jay Gould Defeated.

About a year ago, the then Commissioner of Patents ordered a patent to issue to T. A. Edison and G. B. Prescott, for quadruplex telegraph instruments, the latter individual being part assignee. Edison sought, by appeal to the Secretary of Interior, Delano, to set aside the Commissioner's decision and prevent Prescott from obtaining his share in the patent, on the pretence that, before selling to Prescott, he had sold the invention to certain other parties, who were known to be in the interest of the notorious Jay Gould. Delano entertained the appeal, held the papers, and refused to decide the case; subsequently he resigned the office. The new Secretary of the Interior, the Honorable Z. Chandler, has recently decided the matter by dismissing the appeal, which he thinks was unauthorized by law; and he sustains the Patent Office in issuing the patent jointly to Messrs. Prescott and Edison,

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IMPROVED UNIVERSAL EMERY GRINDER.

The machine herewith illustrated offers an excellent example of the rapid progress which is constantly being made in this country, in perfecting and refining the capabilities and designs of mechanical inventions. The reader, on turning back to the issue of our journal of last year in which we published engravings of this apparatus, will see the difference between the old and the new form, the first, being excellent in its way but falling considerably below the last, both in point of advantages and in adaptation of design and material to the purposes sought. In the present device the standard is of cast metal instead of wood, and is arranged to receive a collar which supports the adjustable table, D. By means of the rack and pawl mechanism shown, said table may be placed at any desired hight.

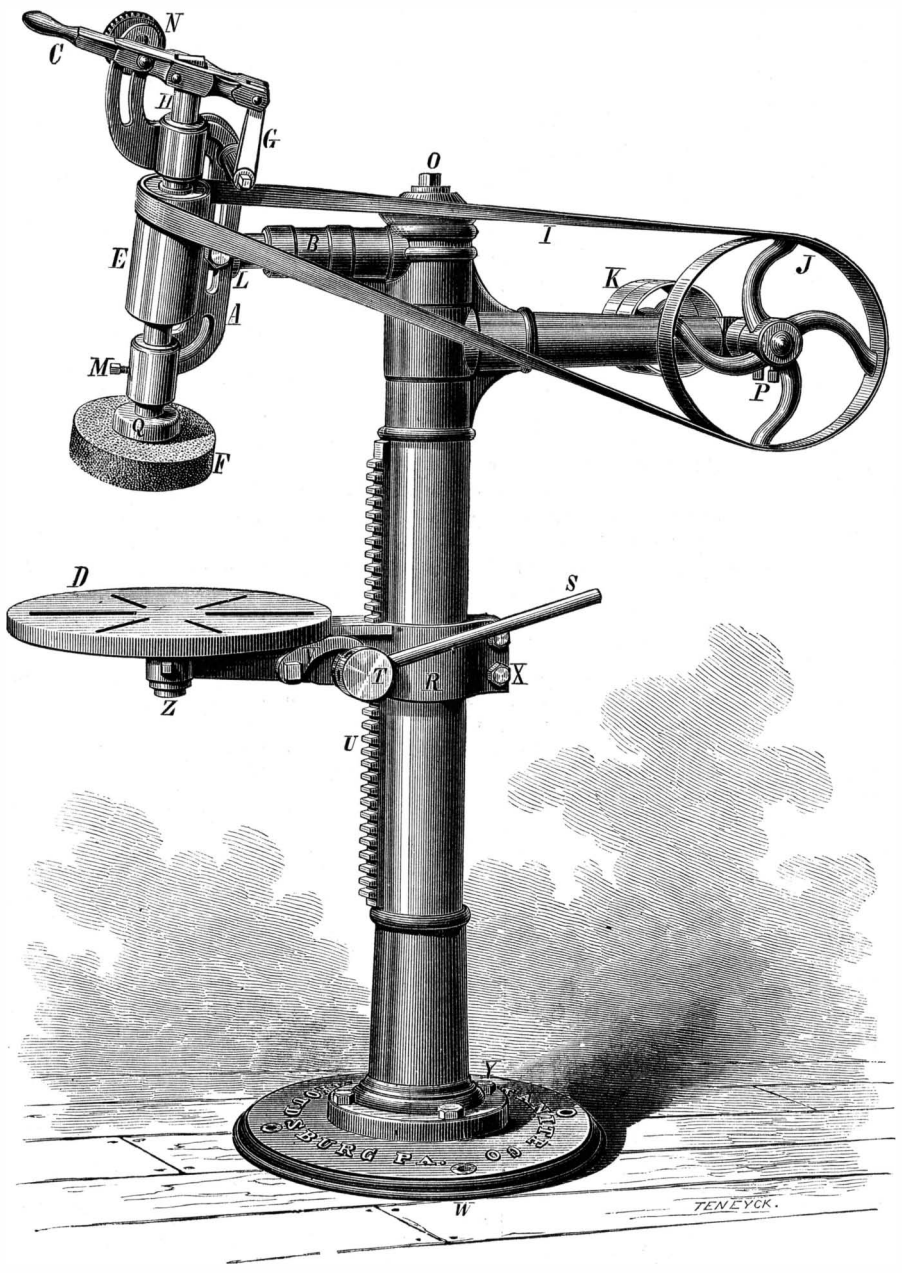
The machine is especially suited to perform a large class of work, done by machinists, stove fitters, and others, which cannot conveniently be performed on horizontal apparatus.

The wheel shaft is mounted in bearings in the frame, A, which, by means of a set screw passing through a slot, is secured to a shank which enters a socket on the standard, B. The shank, by loosening the set screws which confine it in the socket, can be drawn out to tighten the belt which, acting on a pulley on the wheel mandrel, rotates the wheel; or it can be turned in the socket so as to set the latter at any angle. By means of the slot and set screw in the frame, the wheel can be adjusted nearer to or further from the table, as desired. The mandrel has several inches traverse in the frame, so that the pulley can be pressed down or lifted up from the work by means of the simple lever arrangement at C. The lever may be set and held at any position by means of the nut shown, or the former may be counterweighted and operated by a treadle beneath the table.

In order to grind flat surfaces, the wheel is lowered down to them. A conical wheel is used for grinding holes in stove plates, etc., an aperture being made in the table or an auxiliary platform thus provided being secured on top of the latter. For edging plates, the table can be made of sufficient size to sustain the whole weight of the plate, so that the attendant can bring a more even pressure on the wheel with little labor and without danger of injuring it. The wheel can be inclined so as to grind bevel edges with readiness; and by suitably formed grinders, moldings can easily be ground.

The wheel may be adjusted to become an ordinary horizontal grinder; while the substitution of a wooden pulley for the emery wheel turns the machine into a handy contrivance for the use of an emery belt.

The machine is manufactured by the Tanite Company, of Stroudsburg, Pa., who may be addressed for further particulars.



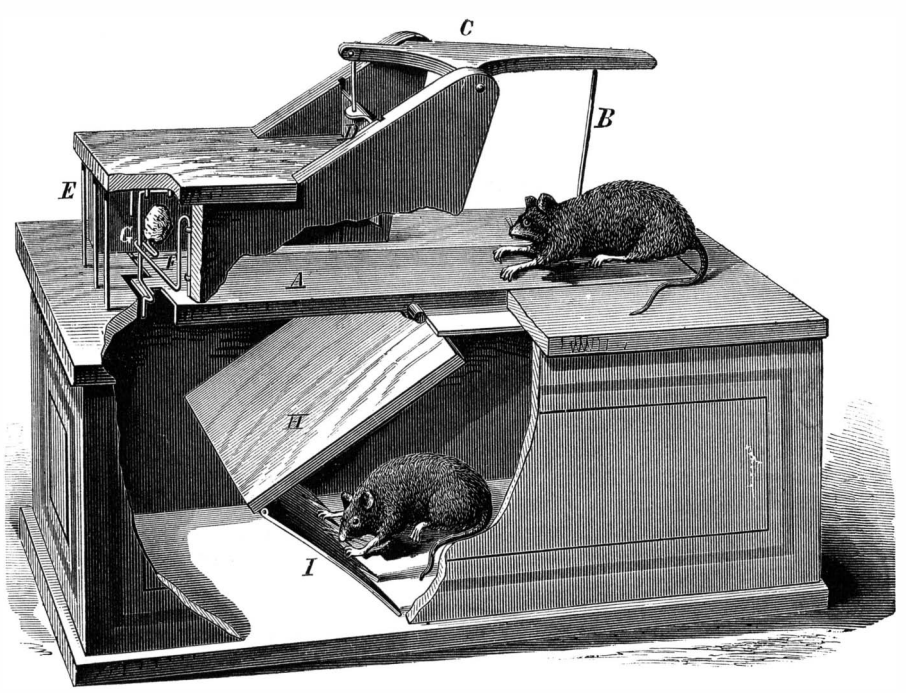
SANFORD'S UNIVERSAL EMERY GRINDER.

IMPROVED ANIMAL TRAP.

In the annexed engraving we illustrate a novel and ingenious self-setting trap, which may be used for catching any kind of small animal that can be lured by bait. It is entirely automatic in its action, and, it is claimed, will continue its operation until the box is filled with its captures. A is a metallic plate, having flanged edges through which it is pivoted by a central pin. At the front end of the plate is a rod, B, which connects with the vibrating lever, C, to which is suspended the gate, D. The inner end of the plate is inclosed in the box, a portion of which supports the lever, C, as shown. The extremity of the box, E, is open and wired, the object being to allow the animal to clearly see the bait and the light beyond, so as not to arouse suspicion. The bait is attached to a curved rod, F, fastened to the side of the box. This rod is bent around a catch rod, G, which engages with the extremity of the plate, A, and supports the same, as shown.

Attracted by the bait, the animal proceeds to the rear end of the plate. The instant the bait is touched, a very slight movement is sufficient to throw the portion of the catch, G, which sustains the plate, into a notch in the latter, so that the end of the plate is free to descend by the weight of the animal. As this descent occurs, the opposite end of the plate, of course rising, so moves the lever, C, as to cause the gate, D, to be lowered, so that any backward escape of the animal is immediately cut off. The animal then slides down the smooth surface of the plate (the inclination of which is limited by the piece, H), and is launched into the rear compartment of the trap. Hence he is free to emerge under the swinging door, I, but of course cannot return. The plate, A, meanwhile regains its normal position, the bait and catch rods slip into place, and the trap is ready for a new victim.

The apparatus is very simple, and can be cheaply and profitably manufactured. The inventor assures us that he has used it with remarkable success, "one trap," as he expresses it, "catching nearly a wash basin full of mice" in a night. It can be made of any desired size and of any material which will resist gnawing. For further particulars address the inventor, Mr. Wm. D. Wrightson, Queenstown, Queen Anne county, Md.



WRIGHTSON'S ANIMAL TRAP.

Lawns---How to Make and Keep Them.

One of the most beautiful features about a country residence is a well cultivated and well kept lawn. It is also the most difficult spot about a place to keep in order, unless one has the facilities for keeping it irrigated; for the very time of the year when it is most desired that it should look the freshest is, in most parts of our northern and western regions, the driest period of the season. We present herewith some suggestions for the laying out, seeding, and care of a lawn, the result of our own experience and that of others, which we believe will be interesting and useful to a great number of our readers:

In preparing ground for lawns, where the expense is not of so much consequence as the good results, a good subsoiling is preferable, because in such soils the roots go down deep, and in this way get moisture when the weather is dry. Very good lawns can, however, be had by ordinary plowing, as for any good crop. It is best, however, to have the ground plowed up and leveled a year before the grass is sown, or it will sink in places, and then the surface becomes uneven. Where the lawn has been made in this way, and inequalities of the surface exist, earth may be brought in the spring, and spread smoothly over the lawn, and rolled down firm. The grass will grow through this, and make a solid, even lawn.

As soon as the frost is gone, and before the ground is hard, the lawn should be rolled. From various causes, there is generally left an inequality of surface after the winter is over, and this the rolling is to remedy. In spite of all the care to keep weeds out of lawns, they will often get in, especially on lawns that are newly made. The best thing is to have the lawn hand-weeded for the first few years. Early in the season the lawn mower should be set going, but experience is against setting the knives too low. Close cutting we have found to be an injury to the grass. It leaves the roots exposed, and the sun is apt to dry and kill the grass.

A lawn requires an occasional top dressing of manure; but there is no necessity of applying it every year, and it should not be used too green. Well rotted stable manure, mixed with soil, makes an excellent dressing, and should be spread over the lawn at least two or three inches in thickness, early in the spring. Some prefer putting it on in the fall, and leaving it to protect the roots through the winter. There is a diversity of opinion as to the use of manure for this purpose, from the fact of its liability to introduce seeds of weeds, which the use of artificial fertilizers obviates; but we have never experienced any ill effect from the use of the former.

The kind of seed to be sown, to make a lawn, depends upon the climate, condition of the land, and composition of the soil. In the Northern States, the English mixed lawn grass seed, with an excess of white clover and red top, are considerably used; and in the Middle States the Kentucky blue grass does well. Red top does the best in clayey, and the others in lighter, soils. Grasses and clovers are gross feeders, and demand good food, else they will not present a good appearance. The white daisy will often show itself in fields and lawns that are too poor to nourish grasses; and to get rid of this pest, it is needful to make the soil richer. The truly practical man, says an agricultural writer, will dress his worn-out grounds with either superphosphate of lime or Peruvian guano, or some other good fertilizer. They will soon show that the grasses can drive out the daisies or mosses, if they are only properly fed. A surface dressing of superphosphate of lime will also cause an abundant growth of clover, and often it will occur where the clover has not before been seen; and even nitrate of soda will give to the new growth a deep richness of color, and thicken the turf rapidly. The constant cutting and carrying away of the grass produces exhaustion of the soil, until at length it becomes so poor that the grasses die out in a great degree; and the daisies and mosses take their places, until fresh plant food is given, and their growth strengthened. There are some strong, deep soils upon which time seems to make little impression, and no manure is required; but they are only the exceptions.

Boxwood Edgings.

In the spring, move back the soil and gravel, roll the walks nicely, and they look as clean and fresh as if new. Before finishing the walks, clip the edgings so as to have them only six or eight inches high. Treated in this way, the top of the edging is sometimes slightly frosted, but no more is injured than is desirable to cut off in clipping. I have practised this method, says a correspondent in the *Practical Farmer*, and have seen others do the same for two score years, and have never seen a failure with it. For dividing walks from beds, both in the kitchen and flower garden, no other edging is as good or as lasting as this. It should never be allowed to grow more than ten inches high, and six inches high and thick is better. When over a foot high and thick, it looks clumsy, injures the crops near it, takes up too much room, and injures the appearance of both walks and beds.

WAX flowers, if left out in the drizzling rain, will be thoroughly cleaned in a short time

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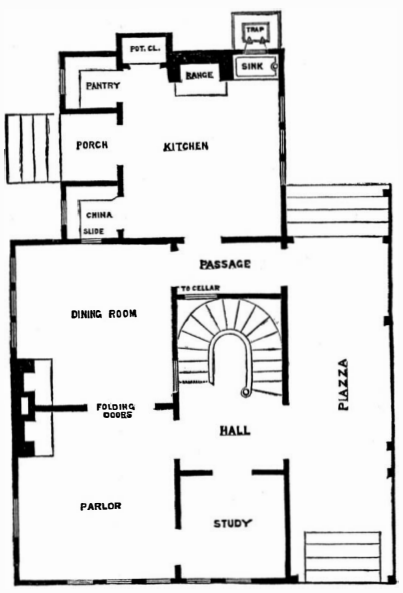
A NEW AND USEFUL ARCHITECTURAL WORK.

We have frequently commented upon the strange lack of taste which has been manifested all over this country in the matter of rural architecture. While villas and other costly residences do, it is true, often exhibit grace, beauty, and originality in design, the same is far from the case in cottages and dwellings of medium pretensions; these, like the ever-recurring brown stone front houses of the city, are but duplicates of a few original types, and one after another is constructed by simple modifications of a few plans made by the builder, without the aid of the architect. With these types, and likewise with their ugliness, every one is familiar. There is the "gothic" cottage, so called mainly because it is irregularly built, and not because gothic style is scrupulously observed; more homely still is the cubical edifice surmounted by a miniature reproduction of itself as a cupola; and ugliest of all is the attempted copy of the Greek Parthenon, with its huge front pillars. For these models, architects are now endeavoring to substitute more tasteful structures, and at the same time are demonstrating successfully that there is room for the exercise of skill and ability in designing a simple cottage as well as in planning an elaborate villa. To produce designs, however, is one matter, and to popularize them is another; the latter involves nothing less than an education of popular taste, and at the same time the demonstration to the public that it is just as cheap and as economical to build a neat, even elegant, house as to construct one that is the reverse. These objects have never been more successfully pursued than through the publication of the many volumes of designs and details by the firm of A. J. Bicknell & Co., of 27 Warren street, in this city. This concern has now hit upon a new way of publishing similar information. Instead of a person employing an architect to produce working plans and specifications according to a selected design, he may procure the original plans and specifications reproduced in accurate facsimile, extending even to shape and quality of paper. The first set of plans just published are of the very neat and pretty Swiss cottage represented in Fig. 1 of the annexed engravings, the lower floor of which is shown in Fig. 2. There are six large sheets of drawings, besides the specifications. It will be observed that the first story is very commodiously arranged. A broad piazza runs nearly the whole length of one side. There is a square hall, about which the parlor, library, and dining room are grouped. The kitchen is in an extension, and thus is separated from the other apartments. It is bountifully supplied with closets and other conveniences. In the second story are four good sized bed rooms, arranged around a central hall, besides a large press or store closet, which might well be turned into



a commodious bath room. Finally, the attic consists of a single large bed room, having windows on all sides.

The exterior of the building is very tastefully ornamented in rustic style, with woodwork trimmings, the whole presenting a neat and handsome appearance. The idea of printing these designs and specifications is a good one, and undoubtedly others will be forthcoming from the same publishers.

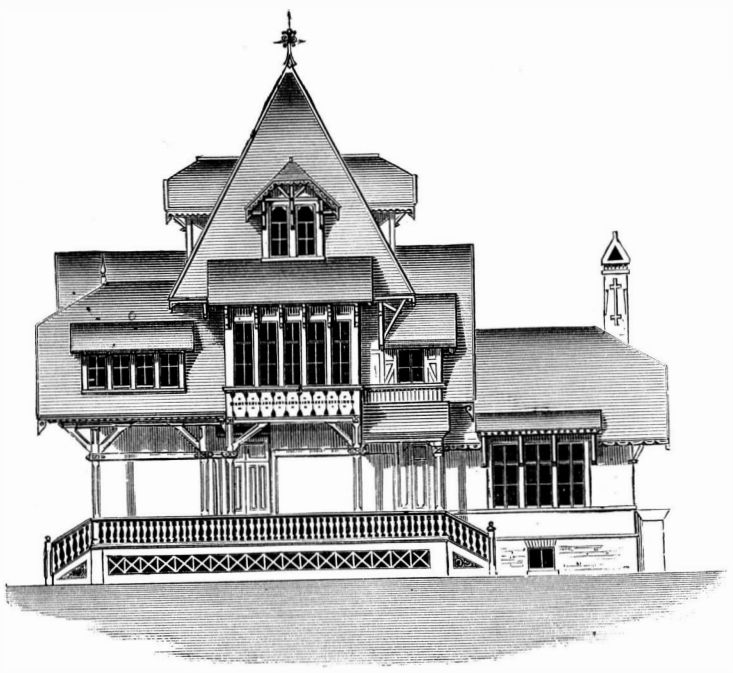
Artificial Ice for Skating Rinks.

Asphalt, pine flooring, patent ice, and all other substitutes for the real thing in skating rinks must give way before the newly invented ice rink of Professor John Gamgee, of London, England, if all be true that is said about it. He is declared to have succeeded in his attempts to manufacture by artificial means a perfect sheet of ice, which can be maintained constantly so as to bear skaters all day and all night long, if necessary. The ice is produced from below by a refrigerating machine, and the members of the London Skating Club who have skated on the rink already formed pronounce it to be the hardest and best they have ever tried. A very extensive rink can be maintained, it is alleged, with a consumption of about 56 lbs. of coal per hour. It is claimed for the ice produced by this method that it has no tendency to produce cold injurious to the feet; but it dries the warm air above, without producing an unpleasant or even an appreciable sensation of cold. We are curious, says the *Building News*, to see how the patentees of the roller skates will welcome Professor Gamgee's invention.

Sold Scientists.

Quite a number of scientific gentlemen in Washington were lately very much exercised over the supposed discovery of a human skull, exhumed from the limestone rock which formed a quarry for building stones in the Osage Indian Reservation in Kansas. The object was firmly imbedded in the stone, many feet below the surface of the ground. Of course such a discovery would be of immense importance, as setting the antiquity of the race still further back than is now believed to be the fact; and when a clergyman from the nearest mission pronounced the round smooth occiput to be a genuine skull, the scientists in Kansas promptly shipped it to another scientist in Washington, and he confirmed the opinion.

After the skull had been viewed and commented upon in the most learned manner by sundry erudite individuals, some one suggested sending it to Professor Meek, of the Smithsonian Institution, Washington. That gentleman quietly pointed out that the sutures visible did not at all resemble those of the human skull, and then shattered all the combined theories advanced by stating that the object was merely a shell, of the genus *goniatites*, a large one of its kind and probably the biggest ever found. It is supposed that thereupon several valuable monographs, "on a human skull from the limestone formation of Kansas," were consigned to various waste baskets.



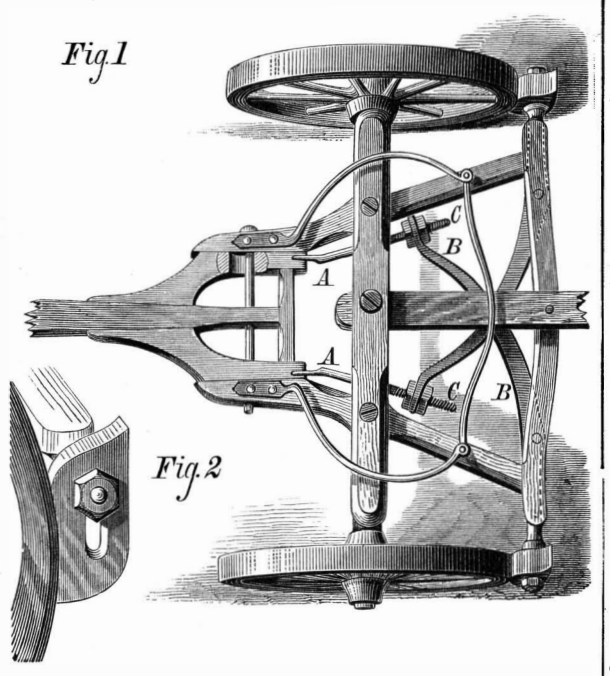
ORNAMENTAL COTTAGE.

MARKRUD'S WAGON BRAKE.

The novel wagon brake illustrated herewith is automatic in its action, and is applied with great force to the wheels through the pushing back of the team upon the pole. Needing no attention from the driver, it is always ready for operation, while the brake shoes are so constructed as to be readily thrown out of use whenever required.

The rear end of the pole is crotched, and in the arms thus formed are long slots, through which passes the fastening pivot. To the extremities of the arms are attached rods, A, which, by screws and nuts, are connected with the curved crossed bars, B. The latter are pivoted, as shown, to the running gear, and carry on their extremities the brake shoes, which are shaped as shown in Fig. 2. The slot through which the pivots of said shoes pass is not symmetrically disposed, but is placed eccentrically, so as to keep the shoe, when reversed, clear of the wheel.

When a strain is brought upon the pole by the pulling resistance of the wagon, the forward ends of the bars, B, are drawn together, and consequently the shoes are held away



from the wheels. As soon, however, as the pole is pushed rearward, then the ends of the bars are spread apart, and the shoes brought in close contact with the tires. It will readily be seen that the shoes only act when their broader portions lie between their connecting pins and the wheels. To throw them out of action, it is only necessary to turn them over, when their narrow portions, being narrower than the distance between the pivot pins and the wheels, cannot come in contact with the latter, even when the pole is pushed inward. The connecting nuts and screws, at C, admit of the accurate adjustment of the various working parts.

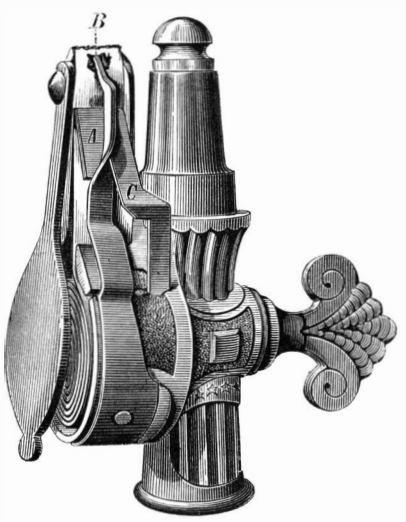
Patented November 2, 1875. For further particulars address the inventor, Halvor Markrud, Ettrick, Wis.

THE STOCKWELL SELF-LIGHTING GAS BURNER.

The annexed engraving represents a new and simplified form of a very ingenious little invention, with which the public are already in some degree familiar. Every housekeeper is aware of the predilection on the part of servants to scratch matches on walls or paint, leaving unsightly marks; children playing with matches have set themselves and many a building on fire; and it certainly is annoying fruitlessly to search through a dark room for a match, when a light is needed in a hurry. These, and many other troubles attendant upon the use of matches for lighting the gas, are obviated by the present device, in which the illuminating apparatus is combined with the burner, and the necessary operation of turning the key produces the ignition of the gas.

Cast in a single piece with the lower part of the burner is a circular chamber, provided with a swinging cover, as shown. Within, and fitting against the wall of this compartment, is a disk, rotated by the key; and a prolongation of the spindle of the latter projects into the chamber and supports a coil of paper, upon which, at suitable intervals, are dots of fulminating compound. This paper tape leads up and over the end of a vertical projection of the box in which it is contained.

A is a bent piece of metal, the lower portion of which enters a slot in the rear wall of the chamber, and has a projection below at right angles, which enters a circular hole in the disk, so that the rotating of the latter, in one way or the other, by the key, causes said piece to ascend or descend. The square upper end of the piece presses against the tape, and consequently raises and unwinds the same, as the key is turned vertically. At the same time, the piece, A, pushes back the spring hammer, B, until the bend in the former at C is reached, at which point the hammer is released and carried forward by the spring, strikes one of the dots of fulminate, explodes the same, and so lights the gas. The arrangement of parts is such that the hammer does not fall until just as the key is placed so as to turn the gas fully on, which insures ignition. Each roll of tape contains 135 fulminate dots, and the cost is less than that of matches. There is nothing about the device to get out of order, nor is there any chance of lighting the fulminate save by the operation specified. No skill is required to operate it, as it works



automatically through turning the same key which must be moved to light the gas with a match. The invention, we understand, is meeting with a large sale, and undoubtedly is one of convenience everywhere, especially in manufactories, hotels, churches, etc. It is manufactured in combination with every style of burner, provided with globe holders or otherwise. The patent for latest improvements is dated December 7, 1875. For further particulars, address the Stockwell Self-Lighting Gas Burner Company, 89 Liberty street (P. O. Box 5,065), New York city.

Artificial Snow Crystals.

The difficulty of observing snow crystals except in a freezing air has led M. Dogiel, of St. Petersburgh Academy, to seek for some substance not liable to dissolve at ordinary temperatures, and crystallizing, like snow, in the hexagonal system. He selected iodoform (CHI_3), a compound familiar to some of our readers from its medical uses. It crystallizes in a remarkable variety of forms. To show their multiplicity, M. Dogiel dissolves iodoform in boiling (90 per cent) alcohol, and lets the solution cool in water of different temperatures. He gets mostly tabular crystals when a solution containing 15 to 30 per cent of iodoform is kept ten minutes in water of about 57° to 60° Fah.; whereas star-shaped and often very complicated crystals are had at temperatures of 78° to 100°.

FADED writing in ink can be restored by brushing over with a solution of sulphide of ammonium.

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Correspondence.

Dividing Circles.

To the Editor of the Scientific American:

From reading the articles by Mr. Joshua Rose, entitled "Practical Mechanism," I know that he is one of the best and most practical mechanics that have seen fit to impart their knowledge to their fellow craftsmen through the medium of any scientific paper; and his articles are the first I turn to upon opening the SCIENTIFIC AMERICAN.

In elucidation of a method of dividing a circle into a given number of parts, spoken of by him on page 84 of your current volume, let me remind your readers that a correct way of doing this is to divide 360° by the requisite number of sides in the polygon, find the chord of the quotient, and multiply by the radius. I have calculated the following table by the above rule, which, upon inspection, will be found to give correct results.

Table of Chords and Angles of Figures Described in a Circle, from Triangles to Polygons with 100 *Sides.—Calculated to* 1 *Minute of the Arc and to* 0·0001 *of Radius.—Radius* =1·0000.

No.of sides.	Angle.	Chord.	No.of sides.	Angle.	Chord.	No.of sides.	Angle.	Chord.
3	120°00′	1·7321	36	10°00′	0·1743	69	5°13′	0·0910
4	90 00	1·4142	37	9 44	0·1697	70	5 09	0 0898
5	72 00	1·1756	38	9 28	0·1651	71	5 04	0 0884
6	60 00	1·0000	39	9 14	0·1610	72	5 00	0 0872
7	51 26	0·8678	40	9 00	0·1569	73	4 56	0 0861
8	45 00	0 7654	41	8 47	0·1531	74	4 52	0 0849
9	40 00	0·6840	42	8 34	0·1495	75	4 48	0·0838
10	36 00	0 6180	43	8 22	0·1460	76	4 44	0·0826
11	32 44	0·5636	44	8 11	0·1427	77	4 41	0 0816
12	30 00	0·5176	45	8 00	0·1395	78	4 37	0·0806
13	27 42	0 4787	46	7 50	0·1365	79	4 33	0·0795
14	25 43	0·4451	47	7 40	0·1336	80	4 30	0·0785
15	24 00	0·4158	48	7 30	0·1308	81	4 27	0·0776
16	22 30	0·3902	49	7 21	0·1282	82	4 23	0·0766
17	21 11	0·3676	50	7 12	0·1256	83	4 20	0·0756
18	20 00	0·3473	51	7 04	0·1232	84	4 17	0·0747
19	18 57	0·3292	52	6 55	0·1207	85	4 14	0·0739
20	18 00	0·3129	53	6 48	0 1185	86	4 11	0·0730
21	17 09	0·2981	54	6 40	0·1163	87	4 08	0 0722
22	16 22	0·2847	55	6 33	0·1142	88	4 05	0·0714
23	15 39	0·2723	56	6 26	0·1121	89	4 03	0 0706
24	15 00	0·2611	57	6 19	0·1102	90	4 00	0·0698
25	14 24	0 2507	58	6 12	0·1083	91	3 57	0·0690
26	13 51	0·2411	59	6 06	0 1064	92	3 55	0·0683
27	13 20	0·2322	60	6 00	0·1047	93	3 52	0·0675
28	12 51	0·2239	61	5 54	0 1029	94	3 50	0·0669
29	12 25	0·2163	62	5 48	0·1013	95	3 47	0·0661
30	12 00	0 2091	63	5 43	0·0997	96	3 45	0·0654
31	11 37	0 2024	64	5 37	0·0981	97	3 43	0·0648
32	11 15	0·1960	65	5 32	0·0966	98	3 40	0·0641
33	10 55	0·1901	66	5 27	0·0952	99	3 38	0 0634
34	10 34	0·1843	67	5 22	0·0937	100	3 36	0·0628
35	10 17	0·1792	68	5 17	0·0922			

Helena, Montana Ter. GEORGE B. FOOTE, C. E.

Sailing Faster than the Wind.

To the Editor of the Scientific American:

If the ice boat question still debatable? Experienced raftsmen tell us that a log sent adrift outruns the stream that carries it, that a single log will outrun a raft of logs, which, in turn, outruns a raft of boards. If these are facts, they indicate the possibility of the ice boats outspeeding the wind. All streams of considerable length have points of slow and rapid flow. Assuming the mean rate to be one mile an hour, the rapids may have a four-mile rate and the slack water a half-mile rate. A log passing each rapid partakes of its speed, and the increased momentum causes it to outrun the more sluggish water below, and thus gain upon the mean rate of the current. A twenty-mile wind may have its thirty-mile gusts, and slack wind to correspond; and an ice boat, by the aid of the former, may gain upon the mean rate. On the other hand, aeronauts in a fifty-mile wind experience a perfect calm, that is, they move no faster nor slower than the wind. A balloon, like the ice boat, has momentum; but it moves without friction, and it is difficult to understand why it should be distanced by an ice boat if both are driven by the same wind.

Rochester, N. Y. E B. WHITMORE.

The Wisconsin Ten Thousand Dollar Reward.

To the Editor of the Scientific American:

I would like to answer, through the columns of your valuable paper, the numerous letters I am receiving from all parts of the country concerning the bounty of $10,000 offered by this State for a steam wagon that will fill certain requirements. To fill the bill, the machine must travel 200 miles north and south over very poor roads that are often sunk or worn down—in the wheel and horse tracks—six inches to a foot below the common level, but with a ridge in the center, the ridge being impassable for a horse: more so for the wheel of a steamer, when we take into account the stumps and stones, avoided by a double team and left in the center ridge. Our wagon track is about 4 feet 6 inches outside, and that must be the gage of a steamer, which machine should not weigh more than two tuns and must be so arranged that it will climb steep sand hills, cross poor bridges, run easily over bogs, stones, and grubs, and out of ruts, etc., just as a loaded lumber wagon does; and it must travel at the average rate of 5 miles per hour, and, in the language of the law, "be a cheap substitute for horses and other animals on the highway and farm."

On the subject of amending the law so as to admit citizens of other States to compete for the prize, I can say that the law will never be so amended, neither should it be, of right. Rather let the public-spirited men of other States elect to their legislatures one or more mechanics and inventors, who are alive to the importance of the class of inventions and who have the courage and persistance to introduce and to fight a bill similar to ours through, as this was fought. It was the opinion of the originator of the law that no machine has yet been produced that will fill the bill, that inventors have failed to bring out a really practical machine; and it was for the especial purpose of encouraging inventors, to persevere until complete success was obtained, that the bounty was offered. G. M. MARSHALL.

Wisconsin Legislature, Assembly Chamber, Madison.
February, 8, 1876.

To Find the Side of a Polygon of any Number of Sides.

To the Editor of the Scientific American:

In the given circle draw a diameter, and produce it a distance equal to the radius, as A B, in each of the following

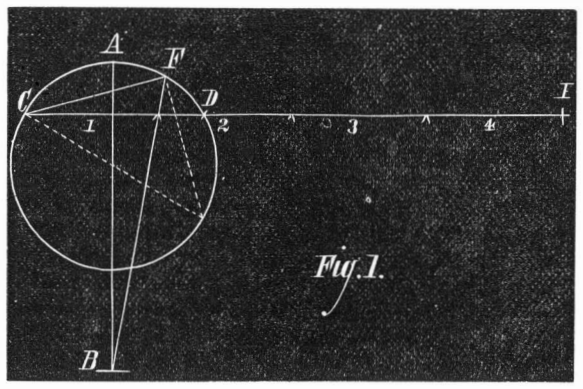


Fig. 1.

figures. With the same radius, on A as a center, cut the circle in C and D. Draw C D, and produce it to E, making C E, equal to three times C D. Divide C E into as many equal

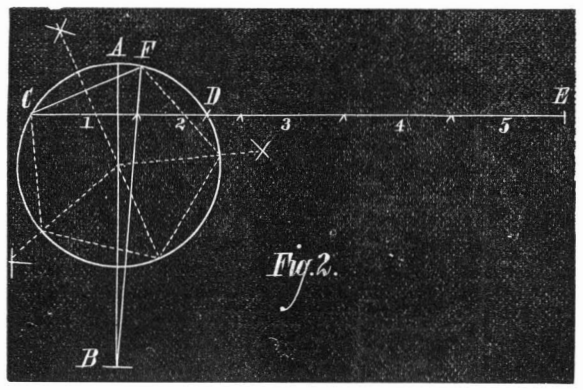


Fig. 2.

parts as the required polygon has sides. Draw B T, cutting C E, in the first point of section and touching the circle in F. Draw C F, which is the side required.

Fig. 1 shows the side of a square; Fig. 2 the side of a pentagon; Fig. 3 a triangle and a hexagon. It will be noted that, in the triangle, C F coincides with C D, and in the hexagon, B F coincides with A B. Fig. 4 shows a heptagon.

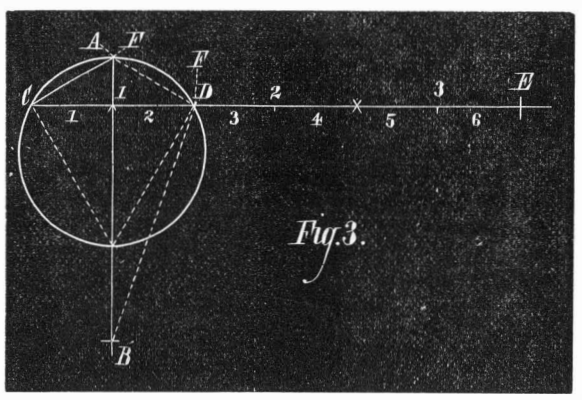


Fig. 3.

Demonstration:—When the side, C F, is found, place other lines equal to it in the circle with their ends in contact, until the polygon is complete; then, if it has an even number of sides, a diameter which bisects a side or an angle on one side of the center does the same on the opposite side. If it

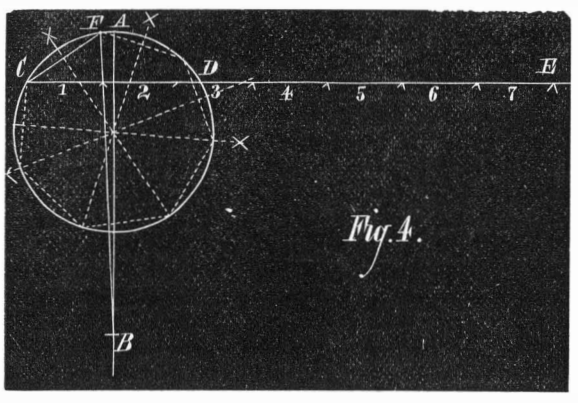


Fig. 4.

has an odd number of sides, a diameter which bisects a side on one side of the center bisects an angle on the opposite side; thus proving that the sides are regular, and consequently equal. ALBERT BONDELI.

Philadelphia, Mo

The Azoic Period and the Glacial Epoch.

To the Editor of the Scientific American:

In one of his lectures on glaciers, Agassiz said: "If it can be demonstrated that such was the condition of our earth (covered with glaciers), it will follow that the doctrine of transmutation of species and of the descent of animals that live now from those of past days is cut at the root by this winter, which put an end to all living beings on the surface of the globe." Now as glacial action is everywhere visible on the surface of the globe as it now is, it is evident that the glacial period was after the earth had assumed its present form. But if the glacial epoch was before the appearance of animal life upon the earth, then it must have been during the azoic age or before it; and there can be no evidence of a universal glacial epoch in these formations succeeding the azoic, since they would all be covered up by the subsequent formations.

There seems to be a slight confusion here; can any one throw any light on this subject?

Franklin, N. Y. P.

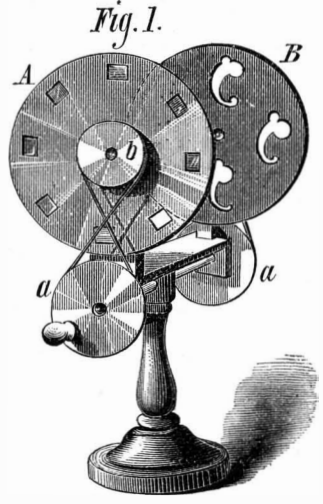
[For the Scientific American.]

THE CHROMOSTROBOSCOPE.

BY PROFESSOR A. RICCO, OF MODENA, ITALY.

The following simple device, which I have invented, is productive of very brilliant results. The two pulleys, *a a*, are made to turn together by means of the crank, and communicate their motion by means of endless cords to the wheels, *b*, to which are attached two disks of cardboard, A, B. In the anterior disk are eight holes, containing little glass windows of different colors. The disk, B, has a white design on black ground. The best way to make the design is to cut it out of the black cardboard and to place oiled white tracing paper behind the latter. On keeping the eye at a point which the apertures successively pass, and looking at the design through them, a colored image will be produced by each one as it passes, and this image will remain on the retina, by persistence of vision, long enough to make the design appear multiplied symmetrically about the center with great brilliancy of colors. If now the figures, of which the design consists, are made to change successively in form and position, as in Plateau's phenakistoscope, the surprising effects of the graceful motions of the images in that apparatus will be combined with a splendid coloration.

Fig. 1.

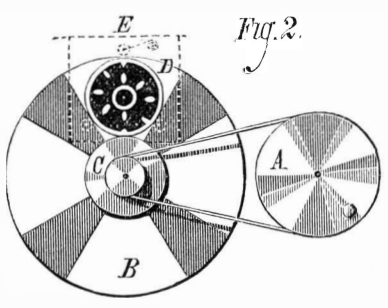


Even by simply putting colored glasses in the apertures of the phenakistoscope, and using white designs on a black ground, similar results are obtained; they are less brilliant, however, because, as is well known, the design in that instrument is placed on the perforated disk itself, and we look through the latter at the reflection of the design in a mirror in front of the apparatus. Of course light is lost by the reflection.

If it is desired to project the images of the chromostroboscope on a screen, the arrangement represented in Fig. 2 may be employed.

By turning the wheel, A, we set in rotation the disk, B, which contains sectors of colored glass. Together with this disk, the wheel, C, turns, on the circumference of which rests a disk, D, which may be either perforated or painted black on colorless glass. The wheel, C, and the disk, D, turn together by friction gearing. The pulley, E, which, together with two others, keeps the disk in place, is movable so that the disk can be taken out and replaced by another, like the slides of a magic lantern, while the other parts of the apparatus may remain in undisturbed connection with the lantern.

Fig. 2.



Modena, January, 1876.

[Evidently this apparatus has a certain analogy to the new chromatrope of Professor Morton, described on page 344, volume XXXIII, of the SCIENTIFIC AMERICAN.—EDS.]

SINGULAR ELECTRICAL EXPERIMENTS.

BY PROFESSOR A. RICCO, OF MODENA, ITALY.

In studying the effects of electricity, it is interesting to note the curves or trajectories passed over by particles of electrified powders. In order to observe them conveniently, they may be illuminated by a ray of sunlight. On putting a little lycopodium or other powder on an insulated conductor, A (Fig. 1), and charging the latter, a jet will be produced which will diffuse a little of the powder in the air; after some time, when the jet has ceased and a non-insulated conductor, B (Fig. 2), is brought near, the jet is reproduced, and

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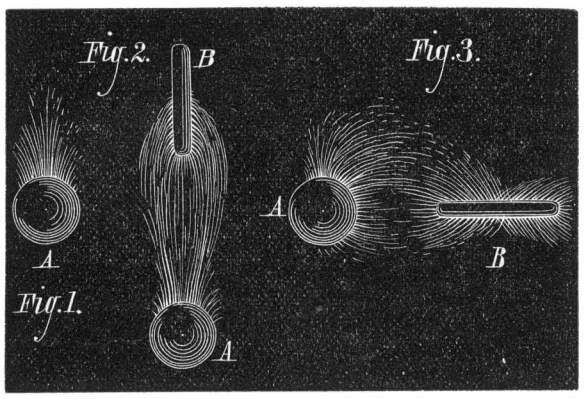
appears formed of an infinity of beautiful similar curves, the extremities of which are almost normal to the surface of the conductors. If now B is electrified and brought near A, in communication with the earth and carrying lycopodium powder, a similar jet will be produced; but if A is then insulated, the jet disappears, and is renewed only when the communication with the earth is restored, by which the electricity of the same kind as that in B is carried off. If a cylindrical, not charged, and not insulated conductor, carrying lycopodium at its extremity, is placed opposite a charged conductor, a jet will arise at that extremity, by which electricity of the same kind will pass off, repelled by the electrified body. And if we sprinkle lycopodium powder on the strongly charged conductor, A (Fig. 3), and on B, containing an induced current, three systems of curves or jets will be formed: one from A to B, another from B to A, and a third from B into the air. Similar, although fainter, curves are observed under the conductors. In all these experiments the particles have a rapid motion to and fro between the two conductors, because the moment they touch one, and are charged with the same electricity, they are repelled. Sometimes a few particles vibrate without touching them (like Franklin's gold fish) and move in the same trajectories.



I have made a great many other experiments with these powders, and I believe they may be useful to the study of that mysterious agent, electricity. The analogy of the curve of Fig. 3 to the magnetic spectrum of a pole of lodestone, A, inducing magnetism in a piece of soft iron, B, is evident.

Modena, January, 1876.

Coal Tar.

Its general properties vary with the coal used as well as with the temperature employed in the distillation of the gas. That obtained at rather high temperature varies from 1·120 to 1·150 in specific gravity. It cannot be burnt in ordinary lamps. If obtained at a lower temperature, it is lighter, and generally is combustible in common lamps. In England the yield is from nine to fifteen gallons per tun of coal.

The distillation is conducted on a large scale in some of our cities. The plan and operations with some are as follows: The liquid is poured into large iron retorts holding several hundred gallons. Heat is then applied. The first portions passing over consist chiefly of ammonia, and a few of the lighter hydrocarbons. As the distillation proceeds, heavier matters pass over, such as water containing a fetid brown oil which collects on its surface. After a little while, the water has all passed over and more oil comes, growing gradually heavier until its specific gravity exceeds that of water. This oil generally amounts to from five to ten per cent of the tar. It is purified by agitation with sulphuric acid and redistillation. The oil before purification contains several easily oxidizable substances, which are converted into a tenacious, dense mass by the action of the acid. The purified oil is called coal naphtha. On continuing the distillation after the naphtha has ceased to come over, a heavy, fetid dark oil, known as dead oil, comes. This usually amounts to about thirty per cent of the tar. In the latter part of the distillation, considerable naphthalin passes over and solidifies in the oil. The operation is usually stopped here, as the mass in the retort will solidify on cooling, and is used to form a black varnish for iron work.

If desired, however, a still higher heat will decompose the matters left in the retort, and a product may be obtained which when cool has the consistence of butter, and is called anthracene. At a still higher temperature, the distilled matters look like resin, and finally the substance passing over at a red heat condenses as a bright orange-colored powder, and is composed principally of chrysene and pyrsene. The residue in the retort is a coke which is very hard and difficult to burn.

The naphtha obtained as above is usually rectified with sulphuric acid again, and is separated into still lighter compounds and heavy oil. The distillate from this is free from naphthalin, does not change color on exposure, and is called "highly rectified." It varies in specific gravity from 0 860 to 0·900, and contains several oils which may be separated from each other by proper caution in distilling.

Mansfield succeeded in separating this into at least five different substances. No. 1 boiled between 140° and 158° and smelt like onions: probably a mixture of alcohol radicals. No. 2 boiled at 176° and consisted of benzol. No. 3 boiled at about 235° and consisted of toluol, mainly. No. 4 boiled between 288° and 293° and resembled cumol. No. 5 boiled between 338° and 342° and resembled cymol.

The dead oil is seldom purified. It consists mainly of carbolic acid, aniline, quinoline and several other bodies, mostly hydrocarbons, which boil 290° and 570°, and usually have considerable anthracene in solution. This oil is valuable for its antiseptic properties, and is used to preserve railroad ties in some places. It has been used in common lamps but is chiefly used to make lampblack. Probably the time is coming when this oil will be used for fuel in steam boiler and allied furnaces.

By a slight change in the order of collecting the products of distillation, a green oil may be obtained after the dead oil. This is used principally as a lubricant for railway engines and cars. In some cities the only use to which this tar is put is for roofing purposes. It is then boiled in the open air in pots holding comparatively but a few gallons. When enough of the more volatile products have passed off, the the whole is run into barrels to cool. When wanted the barrel is knocked apart and the mass remelted.—*Professor H. Poole, in Scientific Commercial.*

The Sun's Atmosphere.

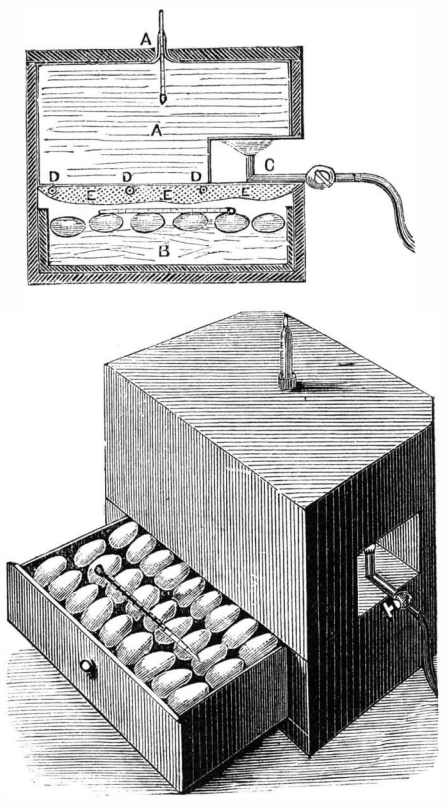
Professor Langley, of Alleghany Observatory, has lately published some results of his steady observations of the solar atmosphere, which, he states, is a thin stratum which cuts off one half the heat which otherwise would reach us. From this it appears that the existence of living beings upon the earth is directly dependent upon the sun's atmosphere, for should that envelope be increased twenty-five per cent in thickness, the mean surface of our globe would, it is estimated, be reduced 100° Fah., in temperature. It has been suggested that the glacial epoch through which the earth passed many ages ago might have been due to a fluctuation in the solar atmosphere.

A Telegraph Cable Pierced by Grass.

At a meeting of the Asiatic Society of Bengal, in Calcutta, says *Chambers' Journal*, a piece of telegraph cable was exhibited, showing that the india rubber covering had been pierced by grass. The piercing was so complete and the contact of the grass with the copper core was so perfect that "dead earth," as it is technically called, was produced, and the efficiency of the cable destroyed. The species of the grass, owing to its dried-up condition, could not be determined. It was suggested as a probable explanation "that the seeds had become attached to the core when under water, and had afterwards germinated when the core was stored."

IMPROVED INCUBATOR.

A correspondent of the *English Mechanic* has recently improved upon the incubator introduced by M. Carbonnier, and we publish herewith an illustration of the apparatus in its present form. "The apparatus," says the writer, "which I used with success, consisted of a box with a zinc case, A, filled with hot water, fixed in the top, and underneath a drawer, B, to put the eggs in, and in which is spread a quantity of hay, so as to line the bottom of the drawer completely C is a small gas burner sufficient to keep the temperature of the water at 110° Fah., for the eggs to become warmed to a temperature of 105° or 104°, to show which a thermometer is laid on the top of the eggs. The upper A is a pipe for supplying the basin with water and to receive the thermometer, which is immersed in the fluid, and shows the temperature. D D

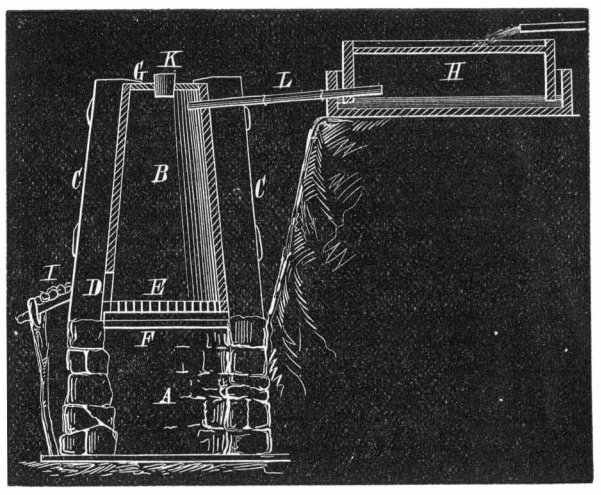


D are three iron rods fixed in from back to front of the box as a support for the zinc case. E is a layer of sawdust, suspended by a piece of muslin (or some such thin material) fastened by a few tacks to the inner side of the box, through which the heat passes, and is at the same temperature and as moist as that which would emanate from the body of a natural mother. The drawer is opened once or twice every day to turn the eggs; and after an incubation of twenty-one days, the chickens will be hatched without any further assistance."

It is stated, upon German authority, that the unpleasant taste imparted to milk and butter by feeding turnips, etc., may be removed by simply throwing into each pan of milk of 4 or 5 quarts as much saltpeter as will lie on the point of a knife, when a gelatinous mass will separate from the milk and settle to the bottom

The Manufacture of Camphor in Japan.

Dr. A. von Roretz, of Otanyama, Japan, states that the only tree which yields the commercial camphor of Japan and Formosa is the *laurus camphoratus*, which the natives call *tsunoki*. It is very widely distributed in Japan, being equally common on the three islands Niphon, Kinshin, and Sikok; but it thrives best in the southern portion of the kingdom, namely, in the provinces of Tosa and Sikok. The sea coast, with its mild, damp air, agrees with it best; and



hence the chief production of camphor is in these provinces.

Camphor is collected the whole year through, but the best results are obtained in winter. When the camphor collectors find a spot with several camphor trees in the vicinity, they migrate thither, build a hut to live in, and construct a furnace for making the crude camphor. When that place is exhausted, the hut is torn down and carried to another place. The method observed in obtaining camphor is very simple. The workmen select a tree, and with a hollow-ground, short-handled instrument begin to chop off regular chips. As soon as the huge tree falls, the trunk, large roots, and branches are chopped up in the same way, and the chips carried to the furnace in baskets. The furnaces are mostly built on the side of a hill near a stream of water, and serve for the wet distillation of the chips. The furnace is of very simple construction. A small circular foundation, A, is built of stone, and upon this is placed a shallow iron pan, F, two feet in diameter, covered with a perforated cover, E, luted on with clay. This cover forms the bottom of a cylindrical vessel, B, forty inches high and tapering to eighteen inches at the top. Near the bottom of this vessel is a square opening, D, which can be tightly closed with a board. The whole vessel is covered with a thick coating of clay, C, held in place by strips of bamboo. The cover of this vessel, G, which is also luted on with clay, has an opening, K, closed with a plug. Passing through the side of the vessel near the top is a bamboo tube, L, leading to the condenser, H. This condenser is merely a quadrangular box, open below and divided up by four partitions into five compartments communicating with each other. The open side of this box dips into water and is kept cool by water drizzling over it.

The manipulations in the preparation of the camphor are as follows: The cylindrical vessel, B, is filled, after removing the cover, G, with chips of camphor wood; the lid is then luted on, and a definite quantity of water poured in through the hole, K, which moistens the chips and collects in the pan, F. It is now heated gently for twelve hours, a small fire being kept up as soon as the water in the pan begins to boil. The ascending vapors, passing through the chips, carry off all the camphor and oil in the wood, and both are deposited on the surface of the water in the condenser, H. At the end of twelve hours, the exhausted chips are removed through the square hole, D, and fresh chips and fresh water put in. At the expiration of twenty-four hours the process is interrupted, the whole apparatus cleaned, and the camphor collected in H is packed in barrels. Here it is very lightly pressed; and the oil, which amounts to at least 25 per cent, and is as clear as water, is poured off from the solid camphor, and both products are sent to market. At certain places the crude camphor is again pressed somewhat harder, when quite a good deal more oil runs through the crevices in the vessels. The tolerably dry product is sent mostly to Osaka, the chief export town for this important article of commerce. The camphor oil, called by the Japanese *shono abura*, is used by very poor people only as an illuminating oil; and in spite of its strong smell and smoke, it is burned in open lamps. Perfectly pure camphor is not exported, but the crude country product is first freed from the still adherent oil by further distillation in Europe. The exhausted chips are dried on a scaffold, I, by the side of the furnace, and are then used as fuel.—*Dingler's Polytechnisches Journal.*

The Planing Mill Controversy.

The *Northwestern Lumberman*, of Chicago, says; "Planing mill owners throughout the country will be interested to learn that the National Planing Machine Company, of Boston, Mass, recently negotiated in this city the sale of their substitutes for the Woodbury bar, for nine States of the West and South. The consideration we understand to have been $250,000. The purchasers are capitalists of this city and St. Louis; and they have organized a corporation for the purpose of putting the business of the manufacture and sale of their devices upon a sure and permanent basis."

A little common soap lather mixed with starch gives linen a good gloss.

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Fig. 4

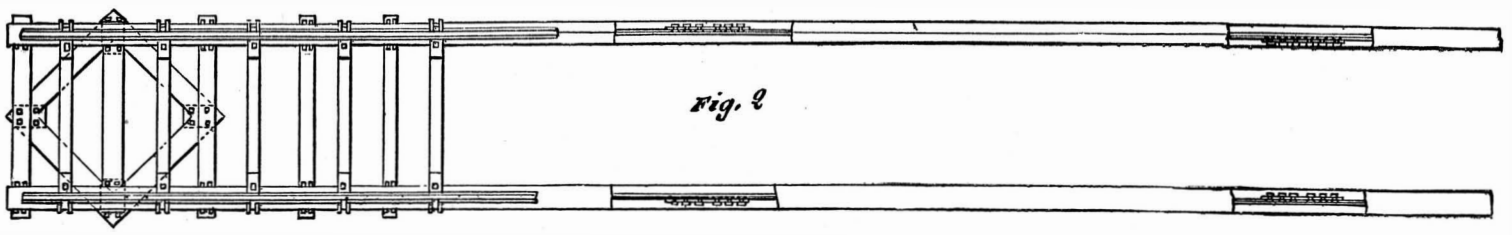
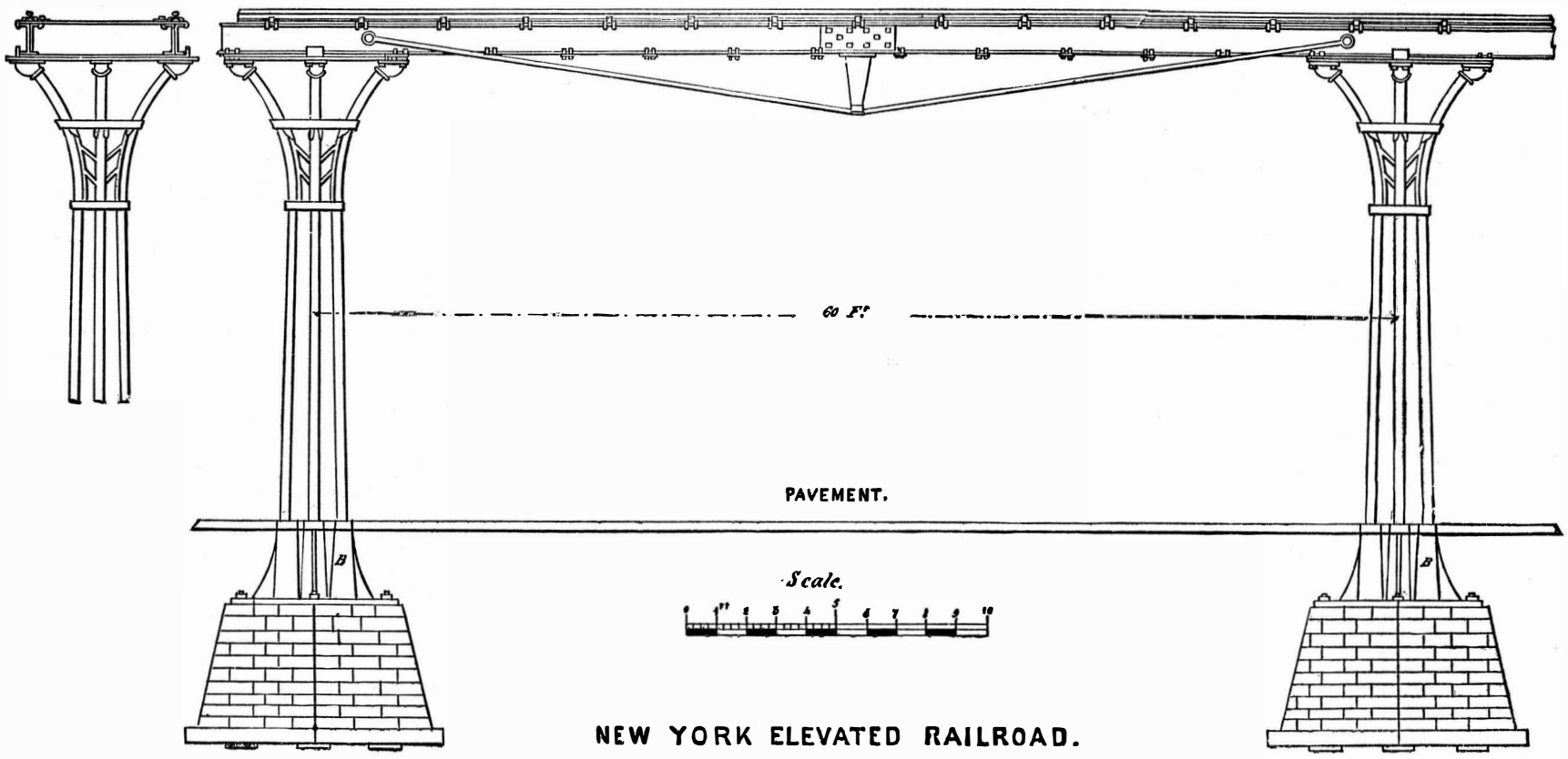


Fig. 2

Fig. 3

Fig. 1



NEW YORK ELEVATED RAILROAD.

(*Continued from front page.*)

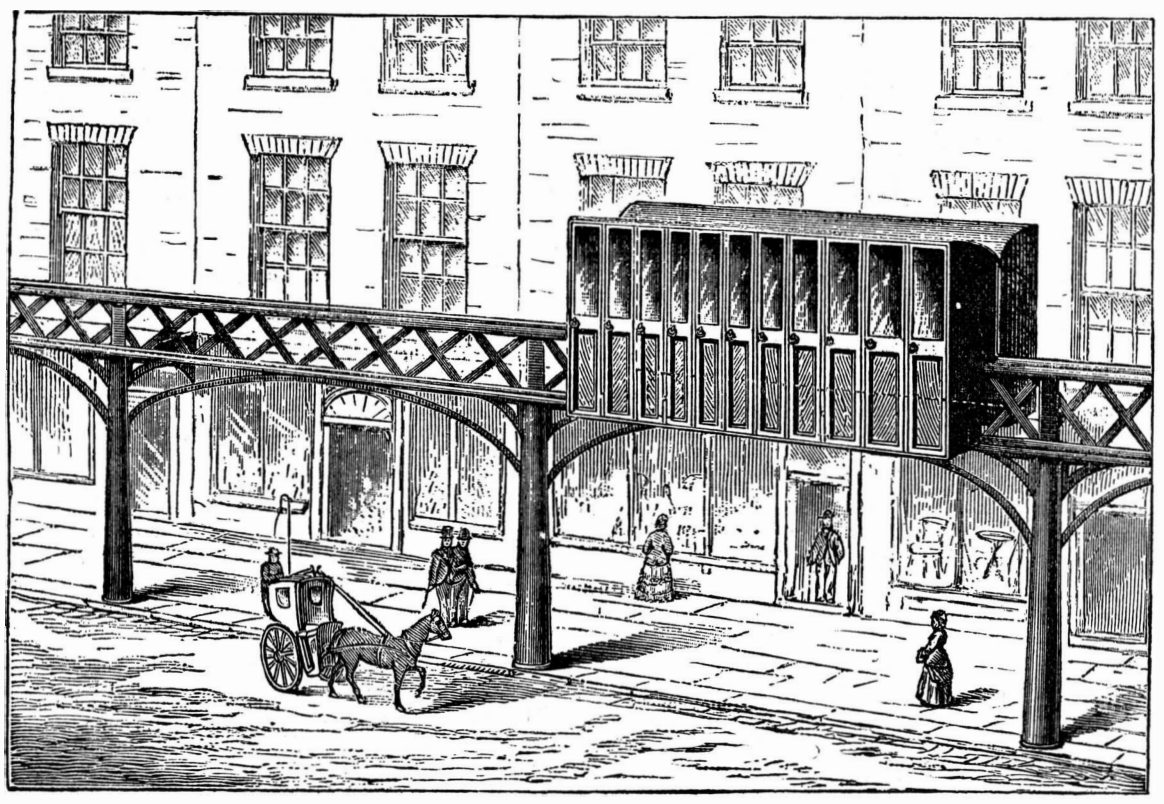
with the system. The Commissioners' plans, which the court is called upon to confirm, have in view the ultimate erection of over thirty-five miles of iron railway bridges, which are to occupy and cover the central portions of many of our finest streets, including Third avenue and Sixth avenue, the Bowery, Chatham street, Park Row, etc. The property owners along the lines have filed the strongest protests against this occupation of the streets. They allege that the soil and drainage of the city is well suited for the economical construction of underground railways; that the first cost of these roads, if regard is had to relative capacity, is no greater than the bridge system; and that there is no reason or sense in encumbering the streets with the nuisance of bridges and locomotives, when the tracks might just as well be put beneath the ground surface, where their operation disturbs no one. But the elevated people claim that their structures will not encumber the streets, that the running of locomotives and trains on the bridges will not be a nuisance, will not depreciate property: instead of this, property will rise, the bridges will improve the appearance of the streets, and all will be nice and lovely. Many excellent engineers support this view; our valued cotemporary, the *Railroad Gazette*, is an advocate. It says:

"The New York Elevated Railroad is located on the street itself, and such a road could be located on the most crowded thoroughfare without obstructing but rather facilitating the traffic and travel on the street itself. That this system of overhead railroads is destined to be very extensively employed, there can be little doubt, and we think in it may be discerned the remedy which civilization will provide for the evil of crowded populations, which seems to attend its advancement the world over. The effect of this system may be, as we have heretofore pointed out, to change, in a great measure, the whole character of metropolitan life, to concentrate in a small area the places of business, and to scatter the houses of the residents over a larger area, and to cover large sections in the vicinity of cities with suburban residences."

THE NEW YORK ELEVATED RAILWAY.

The New York Elevated Railway, Ninth avenue, New York city, shown on our front page is a single track railway, built on iron posts upon the edge of the sidewalk; it has at present a length of about five miles, extending from the southern extremity of the city, at the Battery, to 61st street on the north, near Central Park. The first or experimental section, consisting of a half mile, was put in operation in 1868, under the auspices of Mr. Charles T. Harvey, the original projector of the enterprise, and first engineer of the work. Mr. Harvey foresaw many serious objections to the running of steam engines in the crowded streets of the city, and sought, as a substitute, the employment of wire rope traction. In this he had reached a greater success than had ever before been achieved; but the unfortunate failure of the company removed him and his coadjutors from all connection with the work, and prevented the consummation of his ingenious and excellent plans. After the expenditure of nearly a million in money towards the extension of the work, the company succumbed, and the property was sold by foreclosure, the original stockholders losing nearly everything. The new purchasers, under the title of the New York Elevated Railway Company, adopted the use of light locomotives, and have from time to time strengthened and extended the track, until it has now reached the length above stated. The line runs from the Battery, along Greenwich street, near the river border, to 12th street, where it enters Ninth avenue, and continues to 61st street. A further extension of the road is proposed, and legal proceedings to that end are now in progress, to which we have alluded. The running time at present is 5 miles in 34 minutes. For the engravings and following particulars, we are indebted to the *Railroad Gazette*.

The portion of the line illustrated is supported on columns, designed by D. W. Wyman, C. E., formed out of four round, solid, wrought iron bars, 4½ inches in diameter, bent into the shape represented. These are attached to a heavy cast iron foundation plate bolted down to a foundation of masonry. At the top the wrought iron bars are bent outward into four branches, two of which are for lateral support, and two for longitudinal stiffness. The four bars are tied together with wrought iron bands at the neck of the columns, or just below the point from which the bars begin to branch outward, and also at the top. These columns are placed from 30 to 60 feet apart, and the roadway between is supported on two wrought iron girders, each formed of two 12 inch channel bars. These are trussed at the street crossings, as shown in the sectional view, but not in the shorter spans. The perspective view is from a photograph taken above 34th street, looking southward. On a portion of the line near 34th street, the company adopted a form of posts designed by Mr. Charles Macdonald, C. E. In this the support consists of four posts distributed in a similar manner to the round posts designed by Mr. Wyman. Each of Mr. Macdonald's posts consisted of four 3 inch angle irons, riveted back to back, forming a cruciform section.



ELEVATED RAILWAY PROPOSED FOR OXFORD STREET, LONDON.

The stations are usually placed over the street crossings with the stairs leading down the cross street. The equipment of the road consists of six engines and twelve cars. The engines weigh 8,000 lbs. each; the cylinders are 7 by 10 inches, and the four driving wheels 30 inches in diameter. The cars seat 48 passengers and weigh 11,000 lbs. As two cars are usually run to each train, it will be seen that the actual weight of train, including engine, is only 312 lbs. per passenger. The road is laid chiefly with iron rails of 36 lbs. weight per yard, but some new steel rails have been

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put down. The hight in the clear above the street crossings is in no case less than 14 feet, but, in order to equalize the grades, is often more. The heaviest grade is 127 3/10 feet per mile, and the shortest curve of 56 feet radius.

PEN SKETCHES OF RAPID TRANSIT.

The plan shown in the upper section of our engraving, at the left, gives an idea of the appearance of the Gilbert Elevated road, the building of which, on Sixth avenue, was lately begun, but has been temporarily suspended.

The Hanna plan is shown in the two lower sketches, at the left.

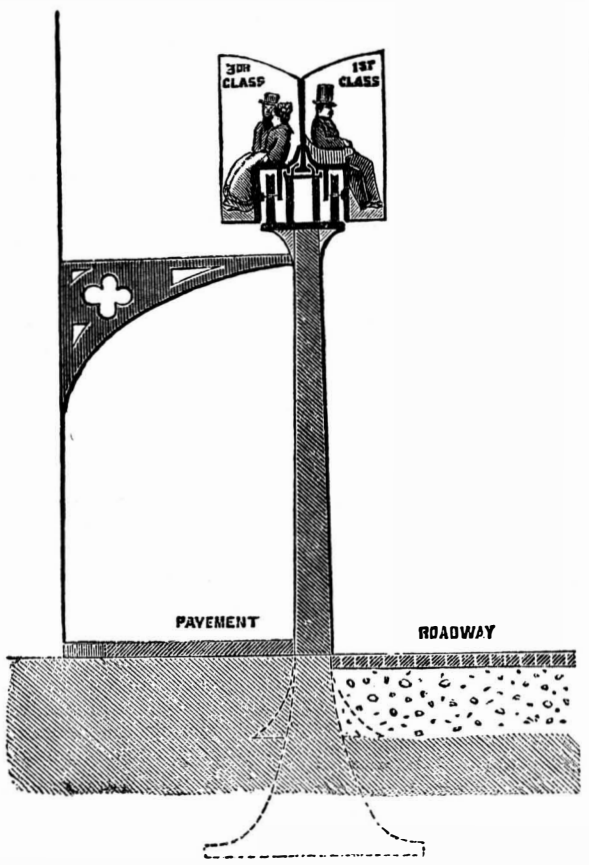
The saddle railway of General Le Roy Stone is represented in the upper and lower sketches at the right. This plan is claimed by the ingenious inventor and his friends to be the cheapest, best, and least objectionable form of elevated street railway that has ever been devised. We gave an account, on page 294, volume XXXIII., SCIENTIFIC AMERICAN, of the practical and highly successful trial of a section of this railway, at Phœnixville, Pa. There is no accounting for tastes, otherwise it might seem strange that some people should be unable to perceive any lines of grace in this structure, while others regard it as a thing of uncommon beauty. Our English cousins are evidently among the latter category; for they have hastened to adopt General Stone's invention, without credit to him, and have added a few modifications which they consider to be an improvement.

THE PROPOSED ELEVATED RAILWAY, LONDON.

We give an engraving of the recent British improvement on General Stone's plan, which we copy from our London cotemporary, *Iron*. The editor says:

"Let a single line be built between the Post Office and Piccadilly or Oxford Circus, *vid* Newgate Street and Holborn, and either Long Acre or Oxford Street, with two intermediate stations. An equally, or even more, favorable route would be that between King William Street and the Elephant and Castle, with one intermediate station. It is remotely possible they might not succeed to the extent anticipated; even then, the money would not have been utterly thrown away. Both lines might be constructed at a cost very much less than that of a single mile of underground railway, and their construction would seem to offer a far more remunerative outlet for our daily accumulating surplus capital than foreign loans or competing lines to Brighton. The present time, when iron and steel are obtainable at moderate prices, and it is barely possible to obtain a return of 4½ per cent on investments, is particularly favorable to such an enterprise.

"The southern line would have the advantage of relieving London Bridge of a great part of the omnibus traffic, which tends so materially to the existing block, besides largely diminishing the crowd of foot passengers, and would postpone the necessity of the much debated widening for some years to come. As an auxiliary to such a plan, a line from Aldgate or Bishopsgate by Fenchurch street to King William street, and so to London Bridge, would complete the much needed link between the Metropolitan, Great Eastern, and Blackwall lines, and the eastern tramways, and the systems of the three great southern railways. Let

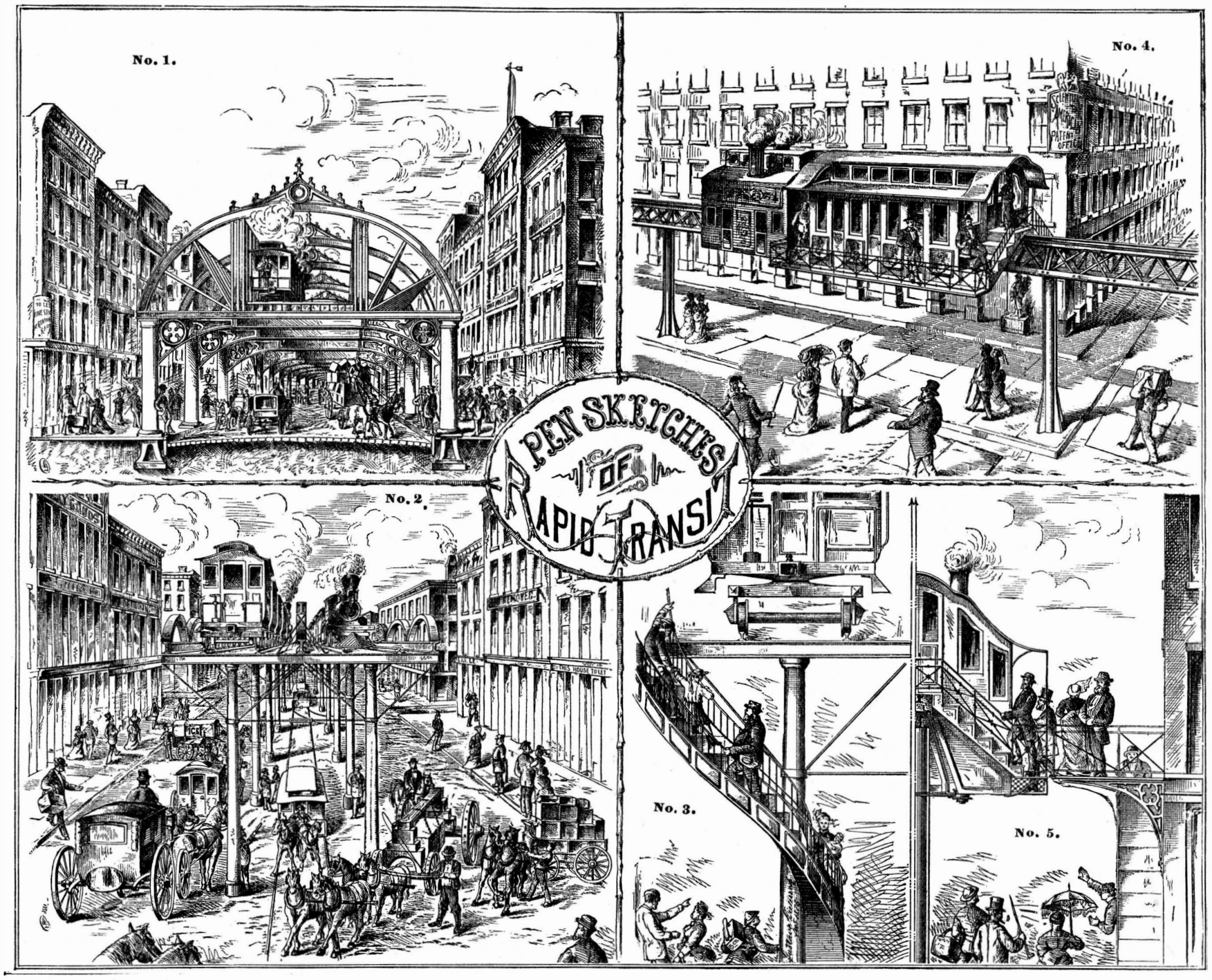


PROPOSED ELEVATED RAILWAY, LONDON.

any one stand for an hour and watch the passing stream of hurrying humanity ever pressing over London Bridge and along the Borough, and he will hardly be long in doubt as to the remunerative character of the traffic which would be offered to any effective system of quick conveyance. The projectors favorite phrase, 'practically inexhaustible,' is here really applicable.

"By adopting a system of air lines, no existing interests, excepting those of the proprietors of inferior conveyances, would be injured' while the proprietors of property adjacent to the routes selected would find the value of their premises largely increased. As to the apparent objections to street railways, it is believed they would be obviated by such a plan as is proposed, and of which we give a sketch outline, rather courting than deprecating criticisms and suggestions, on a subject in which millions are directly interested.

"At intervals of from ten to fifteen yards along the kerb of the selected thoroughfare, wrought iron or steel columns are planted, deep down, into masonry or concrete foundations, but leaving, as we have said, at least 15 feet clear above the pavement level. The construction of these pillars would require great attention, so as to secure a maximum strength with a minimum mass. An elliptical section would probably offer the greatest resistance to the strains to which they would be subjected. In America such pillars have been constructed so as to secure great stability by bolting together four plates of ⅜ inch boiler plate, with the bolted together flanges projecting outwards. Mild steel rolled plates similarly built up, or hollow cast steel pillars, would, however, probably be in the end the most advantageous, considering the necessarily restricted section to which the engineer would be confined. Alternate columns might be strengthened by lateral struts or buttresses of ornamental design, springing from the contiguous buildings. A light double truss girder, with a broad bottom flange, strengthened by an arch as shown in the sketch, rests on the columns, and carries on its base flanges the rails on which the cars run. Cars about 5 feet wide and 20 feet long, in which the passengers would sit back to back, would run on these rails. "straddling" the girder, which, with the car wheels, would occupy the vacant space under the seats. As an additional precaution, the car carries, as a prolongation of its central division, a triangular shaped piece, which runs in a correspondingly recessed groove on the top of the girder, along which it can slide freely, but which effectually prevents the car from diverging from the perpendicular. By this, great stability would be obtained, and an upset be rendered impossible. This might even (to make surety doubly sure) be further provided against by the use of guard rails."



No. 1, GILBERT PLAN.—Nos. 2, 3, HANNA PLAN.—Nos. 4, 5. GENERAL LE ROY STONE'S PLAN.

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Remarkable Whirlwind.

A terrible visitation at Hazel Green, Wis., on the 10th of March last,is described in a special despatch to the Chicago *Tribune* as the result of a collision between two sections of a cloud,which had divided and come together again:

The clouds joined, and a long cylindrical shaft shot down. The cylinder was about 120 feet in circumference and 70 feet in hight. It struck the ground a mile southwest of Hazel Green, and, ploughing a furrow 600 feet long, 4 feet wide, and several feet deep, seemed to absorb the earth and the rocks. As it moved along in a northeasterly direction, it looked like a clay-colored column whirling with incredible speed around a central vacuum. It was a solid mass of heavy rubbish. As the cylinder came up the slope, the rush and yell and whirr of the column—sounding like the rush and shrieks of the wind on the sea, and like the thunder of guns—attracted the attention of the people of Hazel Green, and they flocked to their doors and windows. Steadily it came on, sometimes bounding fifty feet into the air, then rushing down again. In two minutes it descended on the little hazel grove just southwest of the town. The trees were snatched up by the roots and whirled ninety feet into the air and supported there.

The cap of the column was a stone 8 feet long, 4 feet wide, and 3 feet thick. This stone was held in its position while the column covered a space of three quarters of a mile. Just between the grove and the town, 250 feet from either, the column halted and spun around over a small space, and then recommenced its march. The air was filled with the yells and lamentations of the people.

Tearing off a corner of a frame house, the column rose some thirty feet into the air, and then, hovering for an instant, fell perpendicularly upon the roof of the Masonic Hall, a stone building. The structure was mashed flat. This was at half past four, and a meeting had been called for five o'clock. Half an hour later seventy persons would have been assembled in the upper portion of the building. The next house was of frame, and occupied by Mrs. Richards and her family. A daughter in law and her two children were saved by the scantlings above them, while the rest of the family were killed outright. A frying pan containing three cakes was on the stove, and the frying pan, still containing the cakes, was found a mile and a half northeast of the village. Twenty-six houses were carried beyond the ken of mortals. Where they went no one can tell. The track of the column is filled with sawdust and bits of wood, as though a sawmill had belched out a half finished lumber yard. The trees for several miles are filled with chairs, bits of furniture, carpets, clothing, bits of window shades, and household materials. Mrs. Looney was sitting in her kitchen. The house disappeared as if touched by the magician's wand, and the crushed body of Mrs. Looney was found 400 feet off, stripped of clothing and with the skin peeled off her back from her neck down.

Of the rest of those killed nothing can be said, beyond that the bodies were found not less than 200 feet from where they started. A boy and girl were found out on the prairie, wandering about helplessly. They were in a house of which no account has been received. They remembered being lifted into the air, and, when found, were nearly a quarter of a mile from where the house used to be, badly bruised and unable to account for their condition. Probably the most remarkable spectacle was that Dr. Kittoe's horses, which, with barn, buggy, and harness, were lifted 60 feet into the air, and the horses dropped at least 100 rods from the former site of the barn. The column was then a huge mass of *débris*, and a spectator says that the horses went up through the center of the column, whirling around so swiftly that they looked as if torn in pieces. They were found utterly unbruised but stone dead, and not more than 10 or 20 feet apart. The whole affair was over in two minutes, but the devastation was most complete.

Successful Progress of the Galveston Harbor Improvements.

The completion of the survey of Galveston harbor, Texas, by Lieut. Quinn, shows that the western point (where, in June, 1875, there was only five feet of water) has entirely disappeared, and the soundings at that particular spot, in crossing the inner bar, are entirely closed. The deep water of Galveston harbor channel has united with deep water opposite the end of the jetty, and lacks only 750 feet of uniting with the deep water of Bolivia channel. When this connection is made, there will be a depth of over 18 feet on the inner bar. The gabions in the jetty are covered with sand. The old Swash channel is obliterated, and is now connected and forms a continuation of Galveston Island. The depth of water in the shallowest spot at low tide is 14¾ feet; at ordinary high tide, 16 feet. Before the city commenced the pile breakwater, there was only 9 feet of water on the inner bar. The recent work by the government has confined the water to a single channel. The results already obtained are very satisfactory; and there appears no doubt but that the jetty system, as being applied, will terminate in giving Galveston 18 to 20 feet of water over the bar.

The Utilization of Tannery Refuse.

Tannery refuse consist of untanned dried pelt or glue pieces, fleshings,hair,lime deposit, and spent tan. The glue pieces are used for two purposes, the principal of which is the manufacture of gelatin and isinglass. For this industry thousands of tuns of the scraps are sold, and few would imagine that the delicately tinted and flavored molds of jelly sold by skillful confectioners ever had their origin in the foul-smelling waste heap of the tan yards. The dry untanned portions find their second utilization in papermaking, and they are also used for the manufacture of peckers or hammers, for knocking to and fro the ever-flying shuttle. Ordinary size is made from the flesh refuse of the hide,and is extensively used by paper hangers, cotton spinners (to give firmness to the thread),and carpet manufacturers. As to the hair, there has been little demand for it since speculative builders have discovered a mode by which ceilings can be made to retain their positions for a time without its use. Unhappily the demand for cheapness (says the *Journal of the Society of Arts*, whence we take the facts here given) has stimulated the makers of inferior clothing and blanketing to mix hair with wool, thus rendering the fabric heavy without in any way adding to its warmth-retaining capacity. Hair is also used in the fabrication of horse cloths and railway rugs, and, strange to add, the cheap (so-called) sealskin jackets largely sold in England are made from the same material.

A profitable use for spent tan, other than as fuel, remains yet to be discovered. Liebig says that it is valuable as a manure when wholly rotten; some have tried to turn it into charcoal, and to light their tanneries with its gas, but the results have not been very satisfactory. A new process for using this refuse instead of charcoal in the manufacture of tin plates has lately been tried in Wales,and seems likely to be advantageous and useful.

The lime grounds or deposit, although not used for the purpose, is an excellent manure. It contains a mixture of salt, blood, lime, and gelatin. Its analysis is as follows: Moisture 54·05, organic matter 6 80, silica 2·55, iron and alumina 0·84, phosphate of lime 1·85, carbonate of lime 12·42, caustic lime 17·44, common salt 4 05; total 100 00.

A Telegraphic Swindle.

A rather neat swindle was recently perpetrated, on a bank in Dallas, Texas, by three scamps who evidently possessed considerable knowledge of telegraphy and likewise the means of carrying their knowledge into practice. Scamp No. 1, in the character of a wealthy New York cotton buyer,presented himself at the bank with a check for $10,000 to be cashed. He brought strong letters of endorsement, and the check, which had been drawn by the bank's New York correspondent, appeared all regular. In order the more thoroughly to assure the bank, the stranger requested the officials to telegraph to New York for advice. An answer speedily came back, saying that both check and man were good, and the cash was paid. Meanwhile scamps Nos. 2 and 3 went a few miles out of town, rigged a battery and the necessary instruments, and tapped the wires of the telegraph line. When the bank's message was sent, they received it, and sent back the false answer, thus assuring the bank officers, and of course victimizing the unfortunate institution.

Useful Recipes for the Shop, the Household, and the Farm.

The *Housekeeper* gives the following suggestions for utilizing old tin cans. Take off the top of the can, punch holes on opposite sides near the rim, put in a wire bail; and you have a little bucket, which may serve for a paint pot, to keep nails in, or other handy purposes. Take off the top, cut to the proper shape, and fasten on a handle by means of a screw through a hole in the bottom, and a useful scoop may be made. A saucepan for small messes may be made by cutting down a can, leaving a strip to be bent at right angles, and turned around a stick, to serve as a handle. A coarse grater for crackers, etc., is easily formed from a piece of tin fastened to a board. The holes in the grater should be made with an old three-cornered file.

If the globes on a gas fixture are much stained on the outside by smoke, soak them in tolerably hot water in which a little washing soda has been dissolved. Then put a teaspoonful of powdered ammonia in a pan of lukewarm water and with a hard brush scrub the globes until the smoke stains disappears. Rinse in clean cold water. They will as white as if new.

Tasteful ornaments may be made of natural leaves and sprays artificially frosted. This is done by means of powered glass, which can easily be obtained by pounding some bits of glass with a heavy hammer, care being taken to protect the eyes against flying splinters. Dip the object in thin gum water and shake the powdered glass over them. When dry, handsome bouquets can be arranged.

Chloride of calcium is such a deliquescent salt that it attracts enough moisture to prevent glue from cracking. Glue thus prepared will adhere to glass, metal, etc., and can be used for putting on labels with danger of their dropping off.

A correspondent of the *English Mechanic* gives the following directions for fixing pencil drawings: "Lay the drawing on a sloping board, and pour boiling water gently over it; this will remove all superfluous particles of lead, and will bring some of the size in the paper to the surface; boil some isinglass or gum arabic in water to make a very thin size; pour it out on a flat dish to cool; run the drawing through the size, taking care that every part is well wetted; then lay it on a board to dry. The size should be so thin as to feel just a little sticky between the finger and thumb when cool. If too thick, it will be seen on the drawing after it is dry. I have tried many ways of fixing drawings, but have never found any to equal this." Another writer says: "The best solution to fix drawings is that made with gum tragacanth. It sizes the paper; it fixes the pencil drawings; it does not chip when wetted; it enables you to continue the drawing afterwards if desired; and it is possible to color over it."

Salicylic acid, until recently not found outside of chemical laboratories, is now coming largely into use as an antiseptic and as an agreeable substitute for carbolic acid. We give a variety of new recipes for its employment, taken from various sources: A very simple and most useful ointment, which answers admirably in some affections of the skin, is formed of ½ drachm to a drachm of the acid to 7 drachms of simple ointment. A liniment of salicylic acid and olive oil (2 drachms of the acid to 8 ozs. of oil) will be found of much effacacy in burns. Soak lint in the liniment and apply to the suppurating surface. Professor Will, of Aberdeen, who has tested this in some severe cases of burns, commends it strongly in the *Lancet*. For cancerous sores, Thiersch recommends dusting with pure acid,or with equal parts of the powder and starch; or powder formed of charcoal and the acid might be employed for the same purpose, or for dusting over poultices applied to sloughing surfaces. Another ointment is made of: Sperm oil, 1½ drachms; oil of theobroma, 2½ drachms; salicylic acid, from ½ to 1 drachm. This forms a thick paste, which should be thickly spread on lint. The heat of the surface acting on the oil of theobroma, a diffusible ointment is formed, which is a suitable application when it is desired to have the discharge thoroughly saturated with the antiseptic. An ointment less easily acted on by the body heat consists of sperm oil and paraffin, of each 1½ drachms; oil of theobroma, 2 drachms; oil of almonds, 1 drachm; salicylic acid, from ½ to 1 drachm.

DECISIONS OF THE COURTS.

United States Circuit Court---Eastern District of Missouri.

PATENT SAFE FILLING.—UNITED STATES AND FOREIGN SALAMANDER FELTING COMPANY *vs.* NATHANIEL A. HAVEN.

[In Equity.—Before Treat, J.:—Decided October 27, 1875.]

A composition having been described in a prior patent, one who applies it to a new use cannot claim the composition as his invention.

The court cannot take notice of what was not set up in answer against plaintiff's patent.

The legal rule is that, *prima facie*, a reissue is for the same invention as that originally patented.

Section 4,916 of the Revised Statutes of the United States prohibits, in a reissue, not only the introduction of new matter, but also the enlargement of the original claim growing out of the subsequent advancement of the art. This rule controls both the Patent Office and the courts.

Every patent, as to novelty or utility, depends on the state of the art at the time of the claim made or patent issued.

By new matter is not meant merely the introduction of a new ingredient in a patented composition, but any change in the original specification and claim, whereby a new and substantially different composition and results are secured.

Treat, J.:

This is a case in equity for an alleged infringement of several patents, of which the Salamander Company is assignee.

The reissued patent, No. 4,134, dated September 27, 1870, is in reissue of October 5, 1869, for a composition or cement composed of lime putty, as described, with paper pulp or other suitable fibrous non-conducting material, and with the other ingredients named, or their equivalents, etc.; and claims the employment of lime putty, when combined with paper pulp or any other suitable fibrous non-conducting substance, as a material for preventing radiation from heated surfaces, or as an ingredient in any composition used for such purposes.

It is alleged that this patent was anticipated by French's patents, September 14, 1869, which were for the same purposes as the foregoing. Patent A (94,882) was for a composition of crushed asbestos mixed with an alkaline silicate, and B (94,883) an improvement on A, by adding to the mixture a vegetable substance, as sawdust and other woody matter, to make a lighter and cheaper coating.

The reissue to Johns, No. 5,951, dated June 30, 1874, of original patent dated April 14, 1858, is for crushed asbestos and lime mixed with water to be applied.

The defence is mainly for want of novelty—that the inventions claimed by plaintiffs were anticipated, etc. Whatever there is in plaintiffs' patents for which defendant is to be held as an infringer consists of lime putty mixed with non-conducting fibrous material. The subsequent patents on which they rest are for lime putty and crushed asbestos.

It seems, from the evidence, that plaintiffs are assignees of the French patent also, but it is not set upin the bill, though mentioned in the amended answer as anticipating the Bissell and Riley and also the Riley patents. While some of the Johns patents are set out, the reissue above is not mentioned in the answer.

It seems, from a cursory examination of the case, that, if the Johns reissue (not mentioned in the answer), No. 5,951, of June 30, 1874, relates back to April 14, 1868, the plaintiffs' patents as to asbestos and lime putty were anticipated. So, if plaintiffs claim all non-conducting fibrous substances mixed with lime putty, the claim is too broad.

If each reissue relates to the date of the original patents, then the Johns patent anticipated those held by plaintiffs; and, although Johns did not specifically state the use for non-radiation, etc., the plaintiffs cannot, because of the new use to which they apply the composition, claim that they were the first and original inventors of the composition.

The court, however, cannot take notice of what was not set up against plaintiffs' patent.

When this case was before the court previously, it was suggested, that if the reissued Johns patent was valid, plaintiffs' patent was anticipated, and the attention of counsel was also called to the fact that the reissues to Johns had not been set up.

By agreement of counsel, those reissues are now before the court, as if made before this suit was brought, and as if fully set up in defence.

The only additional point, therefore, is as to the validity of the Johns reissue in question, which is for precisely the same compound as that claimed and used by plaintiffs. The legal rule is that, *prima facie*, a reissue is for the same invention as that originally patented.

Section 4916, of U. S. Revised Statutes, copied from the act of 1870, prescribed for what, and under what, circumstances a reissue may be had.

The repeated decisions by the courts, and especially by the United States Supreme Court, in the 1st, 17th, and 19th Wallace, indicate with sufficient distinctness that not only new matter shall be introduced, but that an enlargement of the original claim growing out of the subsequent advance of the art is not to be tolerated. The reason of the rule is obvious. Every patent as to novelty or utility depends on the art at the time of claim made or patent issued; and therefore, if a party, after learning from a subsequent advance of the art, the worthlessness of his original invention, is to be permitted to claim a reissue incorporating what was not originally in his mind, and what had been afterward suggested to him only by advances in the art made by others, then he could, it may be, even without any new invention, override all the elements which would serve to test the validity of the new application. In other words, having procured a worthless patent, and having subsequently learned from the advancing art how, by changing the terms of his patent, it could be made of value, he would, if a reissue including the new matter were permitted, have the reissue not only relate back to the date of the original patent, but absorb within its privileges all subsequent matters wholly unknown to and unthought of by him originally.

This rule controls both the Patent Office and the courts. New matter must not be introduced. By new matter is not meant merely the introduction of a new ingredient in a patented composition, but any change in the original specification and claim, whereby a new and substantially different composition and results are secured.

Such is the reissue in question. It is not only for a composition essentially different, but for one not within the purpose for which the original invention was designed.

The plaintiff is entitled to a decree.

Subsequently the following decree was entered on record:

This cause coming on to be heard upon the pleadings, exhibits, and proofs herein, was argued by counsel, and thereupon, upon consideration thereof, the court doth order, adjudge, and decree that the said several letters patent mentioned and described in the bill of complaint herein are good and valid in law; that the plaintiffs are entitled to the exclusive use and rights under the same; that the said defendant, by the use, manufacture, and sale of the patented improvement described in said letters patent, has infringed upon the exclusive rights of the plaintiffs under the same

It is further ordered, adjudged, and decreed that the said defendant, his agents, clerks, servants, and workmen, and all and every of them be, and they are hereby, enjoined and restrained from making, selling, using, or in any manner whatsoever disposing of any composition for covering steam boilers, and for other purposes, embracing the patents or improvements of plaintiffs in their said bill of complaint set forth. It is further ordered, adjudged, and decreed that defendant pay the costs herein to be taxed, and that execution issue therefor.

[*Samuel S. Boyd* for complainants.
Kellogg and *Fenton* for respondent.]

United States Circuit Court---District of Massachusetts.

COPYRIGHT CASE.—SAMUEL E. LAWRENCE *vs.* JOSEPH E. CUPPLES *et al.*

[In equity.—Before SHEPLEY, J.—Decided October, 1875.]

SHEPLEY, J.:

Complainant is the publisher of a book called "The Advertiser and Collector's Chart," which he has duly copyrighted in accordance with the provisions of the act of Congress, and which he has the exclusive right of publishing.

The publication is a monthly chart, published each month for the purpose of advertising generally, and also contains, in a tabular form, a list of debtors whose bills cannot be collected after due effort, alphabetically arranged, giving the names and address of the debtor and creditor, the amount of the claim, and in some instances the discount at which the claim will be sold for cash.

The bill of complaint alleges that the defendants have published a book entitled "The New England Mercantile Guide," which is a copy of and from the tabular list above described and prepared by Samuel E. Lawrence, the complainant, and that it adopts the plan of Lawrence's work in

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arranging the names and residences of debtors and creditors, and in stating the amounts, and in the objects and purposes of said arrangement.

The answer denies that the book published by the defendants is a copy, in whole or in part, of "The Advertiser and Collector's Chart," and denies that the complainant can have any valid copyright for any arrangement of the names or debtors and creditors, or any other classes of persons, or for stating amounts, or any other purposes of arrangement.

The publication of the complainant is clearly one of that class embracing dictionaries, directories, catalogues, maps, and similar publications where the same sources of information being open to all, the author, by his copyright only, protects himself from a piracy of his own labors by a copy from his publication, but cannot exclude others from publishing similar maps or charts from their own surveys, or similar directories or catalogues, the result of their own labors and compilations, without copying the copyrighted publication or availing themselves of the labors of the author or compiler.

Although the plan or arrangement of a book may be secured to the author, if it be the product of his own genius, there does not seem in this case to be anything in a mere list of debtors and creditors, with their residences, and amounts and value of debts, which possesses any such novelty of plan or arrangement as would preclude any other person from making and publishing from his own independent sources of information similar lists.

The question is correctly stated by the learned counsel for the complainant to be whether the defendants have used the plan, arrangements, and illustrations of the complainant as the model of their own book, with colorable alterations and variations only to disguise the use thereof, or whether the work is the result of their own labor, skill, and use of common materials and common sources of knowledge, and the resemblances are either accidental or arising from the nature of the subject. (Curtis on Copyrights, 258, 260)

Although many of the same names, residences, and amounts appear in the defendants' as in the complainant's tables, the answer positively denies that they were copied, and the uncontradicted proof is that they were derived from independent sources of information. One of the defendants testifies that the names of debtors are bills placed in defendants' hands for collection, and that a great many of the subscribers (creditors) are persons they were doing business with previously to complainant's publication, and that they were obtained through their convassing clerk. The list of names marked as identical in the two publications are testified to have been in possession of defendants previous to the publication of complainant's "guide" or of defendant's "chart."

There is no evidence, therefore, of any infringement of any rights secured by his copyright to the complainant.

Bill dismissed with costs.

[*C. D. Moore*, for complainant.
O. S. Knapp and *C. J. Brooks*, for defendant.]

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

COMBINED LIFE BOAT AND TRUNK.

Wilson E Facer, Toronto, Ont., Can.—The object of this invention is to provide a combined trunk and lifeboat for the use of travelers upon sea-going vessels, which, as a trunk, occupies no more room than the ordinary traveling trunk, and yet, in the event of a disaster, is capable of being unfolded and extended, so as to form, with a suitable covering of rubber canvas, a convenient and effective lifeboat. The invention consists in a rectangular frame and lattice work about the size of a trunk, made lightly of steel and provided with hinged doors, which constitute the trunk or the middle portion of the boat. The stem and stern is constructed alike of a hinged folding frame at each end of the trunk portion, which, together with the said trunk portion, is provided with pivoted folding ribs, which, when the frames are extended and braced, and the ribs opened, form the skeleton of a lifeboat, which is to be covered with heavy duck or canvas, coated with rubber.

IMPROVED CAR AXLE.

Simon Hall and Samuel L. Hall, Ahnepee, Wis.—The object of this invention is to enable the wheels to be adjusted on the axle to conform to different widths of gage which exist on some of our railroads without change of truck. When the wheel is to be adjusted to a narrower width of gage, a sleeve is screwed back, and a sectional washer, made of two semi-sections suitably connected by dovetails, placed between the outer end of hub and collar. The sleeve is then screwed up, so as to force the loose wheel and washer firmly in position, the joints of the hub, washer, and collar being closed by the elastic packing rings to retain the oil.

IMPROVED BALE TIE.

Virgil F. P. Alexander, Greenville, Miss.—This is an improved bale tie for packing cotton and other articles capable of baling; and it consists of a buckle with suitable slots attached to one end of the band, in connection with suitable fastening buttons for attaching the slotted end of the band by passing over the same and through the slot of the buckle.

IMPROVED CROSSCUT SAW HANDLES.

Lewis Shepard, Mace, Ind., assignor to himself and David W. Kennedy, same place.—The object of this invention is to improve the construction of the crosscut saw handles for which letters patent were granted to the same inventor October 5, 1875, so as to enable the handles to be readily detached, to allow the saw to be drawn out of the kerf lengthwise, and to enable the handles to be adjusted in or out upon the saw. The invention consists in the curved and straight handles, secured to each other at their upper ends, and provided with bolts at their lower slotted ends, in combination with the saw blade.

DOOR FRAME AND JAMB PLATE FOR FURNACES.

James C. Longland, Rome, N. Y.—Hitherto door frames and jamb plates for furnaces have been made of cast iron, the door frames having a small pipe cast into them, for the passage of water; but the intense heat of the furnaces acting on the inside of the door frame, and the outer side being kept much cooler by the action of the water, causes an irregular expansion of the cast iron, and, consequently, breakage, after which the water must be stopped, and the door frame soon burns out and must be replaced with a new one. Jamb plates are usually made of cast iron and cooled by the action of blast supplied by a blower. Plates thus constructed and cooled are of short duration. In the present invention the bottom plate is of wrought iron, being forged into one solid piece, having a chamber for a water passage. The cover to said water passage is tongued and grooved to make watertight joints. The side posts are also made of a solid piece of wrought iron, connected with the plate by a screw thread, to make watertight joints. In the top plate, also of solid wrought iron, is cut a water reservoir, which is connected with one of the posts by a passage, thereby causing a constant circulation of water. The jamb plate is also made of solid wrought iron, and is cut out from the bottom up to make a water chamber. The ends of the jamb plate are beveled to fit, the one to the side of the furnace and door frame, and the other to the water bridge bosh, thereby forming a complete water circulation all around the furnace.

IMPROVED MOISTENING DEVICE FOR GRINDING WHEELS.

Andrew A. Hazeltine, New Bedford, Mass.—This consists of a spring-clamped sponge, which is applied to a movable standard, and supplied with moisture from an adjustable fountain arranged above the sponge, said fountain having a spout and elastic cover to discharge, by slight pressure, a quantity of liquid on the sponge. The device forms thus a convenient and readily operated moisture for grinding wheels of all kinds, being easily cleaned and applied to the point where it is required.

ELECTRIC RAILROAD SIGNAL APPARATUS.

Dr. George Whyte, Northview, Scotland.—This invention relates to the establishment of a block system of railroad signals. It consists in apparatus placed upon the train operating in connection with apparatus placed upon the roadway or track, through the instrumentality of line wires, batteries and semaphoric masts, whereby a moving train cannot enter upon the block or section of track before the preceding train has left it without being notified of the fact, both by a stationary signal upon the road and the ringing of a bell on the train, which bell always rings when the signal indicates the presence of a train upon the section in advance, and does not ring when the signal is down and the preceding train has left the section in advance. It also consists in the arrangement of the devices and circuits whereby each train is made to automatically remove its danger signal before going on to the next section, whereby the following train is notified of the fact that the intermediate section is clear.

IMPROVED NUT LOCK.

Samuel A. Brumbaugh, Harrisburg, Pa.—This invention consists of screw bolts with nuts which are set into recesses of washer plates provided at the under side with ratchet teeth. The washers of two adjoining nuts are connected by a key that enters the ratchets by a point and tooth at diagonally opposite ends, and locks thereby the nuts.

IMPROVED MACHINE FOR FORMING PERFORATED LETTERS.

William C. Robertson and Frederick Pearce, New York city.—By forcing down the free end of a lever, the guide and holding plates will be drawn down, forcing pins down through guide and bed plates, and through the strip interposed between said plates. As the lever is released from the pressure, the plates are raised by spiral springs, and by their upward movement draw the pins out so that they may not interfere with the putting in and taking out of the strip to be perforated. By this construction, by removing a detachable plate, the pins may be adjusted to form any desired letter or other device.

IMPROVED ROTARY PUMP.

William T. Doremus, New York city.—In this rotary pump, the fluid is forced through a flexible tube coiled around the face of a cylinder, through the hollow journals of which it enters. The tube is compressed between the faces of the cylinder to which it is attached and of another cylinder. The effect is to force the fluid in front of the point of contact out through the discharge end of the tube and form a vacuum in the rear into which the fluid is forced by atmospheric pressure, so that there will be a continuous discharge.

IMPROVED METHOD FOR TREATING RAILROAD RAILS.

Andrew J. Gustin, St. Albans, Vt.—For the purpose of imparting the proper camber to a heated railroad rail to compensate for unequal shrinkage of the metal while becoming cold, this inventor proposes a combination of three pairs of plain rolls, the middle one being adjustable and placed slightly out of line with the others.

IMPROVED CASK TILTER.

Joseph Barton, Hartford, Conn.—This consists of a cask or barrel supporting stand that is provided at the rear part with a spring bearer that works in a socket hung to the stand, and tilts the barrel when released from the socket by a lever device from the front. When the barrel is emptied to such an extent that the power of the spring equals and gradually overcomes the pressure of the liquor still remaining therein, the rear part of the barrel is slowly and imperceptibly raised, and thus the barrel tilted without causing the least disturbance in the liquor.

IMPROVED GRAPPLING HOOKS.

Gain Beeman and George A. Phifer, Ironton, O.—In this invention the hooks are pivoted to the end of a tube, in which the operating rod is arranged to slide. A spring pawl is fixed on the tube, in connection with notches in the lifting rod, by which to limit the opening of the hooks by the sliding movement of the rod in the tube. The tube may be continuous or sectional, and any form of grappling hooks or scoops may be used.

IMPROVED CAR COUPLING.

Edward A. Goodell, Tecumseh, Kan.—A drawhead is provided at the bottom with a central hook that is curved to guide the entering link and then drop it into a concave rear part. A vertically sliding stirrup is guided in top holes of the drawhead back of the hook, and seated, when dropped, in a bottom recess. When the cars are coupled the stirrup is seated in the bottom recess, so that the link assumes its position above the same. For uncoupling, the stirrup is raised, which carries the link to such hight that it may readily pass out of the drawhead over the central coupling hook. The raised position of the stirrup may be secured by seating the bail in a groove, at the top of the drawhead in front of the stirrup, so that the bail, by its inclined position, supports the stirrups.

IMPROVED PUMP.

John Woodville, Washington, Ind.—With the stirrup of the presser, which produces a suction and force action, is combined a forked detachable lever handle, attached by a forked sliding lock-piece, to retain the handle firmly for pumping, and a fulcrum and stirrup connecting pivot link to give rigidity and stability to the connection of stirrup and handle.

IMPROVED RAILROAD RAIL JOINT.

Henry D. Leishman, Yates City, Ill.—This rail-joint clasp consists of two separate plates fitted to the base and sides of the rail. One extends over the top and along an outer projection of the other, and is bolted thereto, while both plates are bolted through the webs of the rails.

IMPROVED ORE CRUSHER.

Wilson L. Waters, Watertown, Tenn.—This consists in the combination, with two interior movable jaws, of a wheel located between the same, and having diametrical cams, or their equivalents, whereby the strain upon the wheel shaft is neutralized by making the working strain simultaneous upon opposite sides of the wheel.

IMPROVED TREADLE.

George T. D. Barnjum, Boston, Mass., and Wilbur F. Dial, Montreal, Canada.—This invention consists of alternately swinging treadles, connected by belts with an intermediate reciprocating shaft, that operates alternately, by belts in opposite directions, loose sleeves with end eccentrics. The latter engage clutches for imparting, by their alternately reciprocating action, continuous rotary motion to a flanged fly wheel.

IMPROVED CAR STARTER.

Archibald H. Crozier, Carlyle, Ill.—This invention consists of an arrangement of apparatus of novel contrivance, whereby a spring is employed as the brake to stop the car, and as a means of starting it again by the power expended in stopping it, which is stored up in the spring.

IMPROVED FLOUR AND MEAL BOLT.

Edwin Slagle and John M. Graham, Albany, Mo.—This consists of a flat inclined shaking bolt, in which the cloth is arranged in wave-like form, which greatly facilitates the work. The invention also comprises details in the construction and arrangement of the sieve; also knockers for keeping the cloth clean, and also a contrivance of the bolt to cool the meal.

IMPROVED MACHINERY FOR SCREW-THREADING WIRE FOR UNITING THE SOLES AND UPPERS OF BOOTS AND SHOES

Edouard Fromentin, Paris, France, assignor to Joseph M. V. Durand and Joseph Duborget, same place.—This invention relates to certain improvements in that class of machines which cut a thread upon a continuous length of wire, insert the screw into the sole of the shoe, and cut it off, so as to form a secure fastening in one and the same operation. It consists in the means employed for tilting the upper pivoted portion of the machine, so as to bring the devices down upon the sole, in the means for applying the power to effect and definitely control the intermittent rotary move ment and in the construction of the feed for the wire.

IMPROVED PIPE WRENCH.

Edward G. Clinch, St. John, N. B., Canada.—The rear parts of the jaws are connected by two bars, the ends of which are pivoted to the said two jaws to keep them always parallel with each other. With this construction, as the wrench is turned, the jaws will grasp the object with greater force as more power is applied.

IMPROVED WINDMILL

Samuel Shannon, Shellsburg Iowa.—This invention consists of a shield on the sliding hub that shifts the vanes to prevent the lodgment of snow and ice on the shaft, which obstructs the working of the hub. There is also a detachable and adjustable contrivance of the eccentric which works the pump rod, to vary the length of the stroke; a wearing plate, to sustain and take up the wear of the wheel shaft at the end; and a contrivance of the coupling by which the vanes that regulate the opening and closing of the wheel vanes are mounted on the machine and connected with the sliding hub.

IMPROVED GRINDING MILL

James M. Collier, Gadsden, Ala.—This consists of a novel and ingenious contrivance for adjusting, holding, and regulating a concave bed stone to a revolving cylinder. It combines a large number of new contrivances, to explain which, clearly, drawings would be necessary.

IMPROVED CENTERING DEVICE FOR GAGE LATHES.

James E. F. Leland, Bowling Green, Ky.—This device enables blank handles and other pieces of wood to be quickly and accurately centered, so as to prevent imperfect work and loss of stock from inaccurate centering, and to increase the working capacity of the lathe. The invention consists in the combination of a disk, adjustable guides, and a spring with the mandrel of the lathe.

IMPROVED HYDRAULIC AIR COMPRESSOR.

Frank Laurence, Washington, Kan.—This improved air compressor is operated by the direct hydraulic pressure of a limited quantity of water, so that a uniform power may be stored up for various working purposes. There are two cylinders, to which water is alternately supplied from the supply pipe, so as to work the pistons, which are connected by a walking beam that operates the supply valve. A compressing cylinder is arranged above each of the lower cylinders, and operated by valves and pistons at the upper ends of the piston rods. The cylinders are connected, by pipes, with a receiver into which the air is compressed.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED TOY CAP EXPLODER.

Charles Coester, Jr., Bridgeport, Conn.—This consists of two pieces of metal attached to a string, and so constructed and arranged that, on being projected from the hand, they may be caused to strike together by coming in contact with another object, or by having their motion suddenly arrested by the strings, and so explode a fulminating powder placed between them.

IMPROVED PAPER BOX.

Terence Devine, Jr., Newark, N. J.—This box may be readily and securely closed without requiring pasting. It is made from a blank of one continuous piece, with central closing tongues and folding side flaps symmetrically thereto. The top of the box is made of double sections to be locked by the tongues. The box may be printed in any suitable manner on the face and side parts, forming a neat and secure inclosure for letter paper, candies, and other articles.

IMPROVED SNOW SHOVEL.

Eugene Campbell, South Westerlo, N. Y.—The invention consists in the combination of runners with the blade of a shovel. The former prevent the edge of the blade from catching upon the seams of a metal roof, or upon inequalities in a cement roof, and thus portect the roof from being injured.

IMPROVED GLOVE FASTENING.

Frank G. Farnham, Hawley, Pa.—A plate having a rack is secured to one side of the wrist of the glove. A second plate, attached to the other side, is provided with vertical lugs that are connected by a pin. On this pin slides a lever, having a spur, and folded so as to form a loop to receive said pin. The operation is as follows: In order to fasten the glove, the lever is slid forward until the fold strikes the pin, and then raised into a vertical position, so as to be passed through the eye of the rack plate. The lever is then slid in a horizontal direction over the pin, until the spur catches in a tooth of the rack.

IMPROVED INKSTAND.

Jerome Kidder, New York city.—This portable inkstand is composed of a tube or elongated ink reservoir, having a filling and delivery orifice in its upper side, at or near one end. It is adapted for carrying in the pocket.

IMPROVED ROWLOCK.

Frederic A. Gower, Providence, R. I.—The invention is intended to increase the speed and improve the convenience of racing boats with outriggers, by providing them with rowlocks that prevent wabbling, crabs, and other interruptions. It consists of a rowlock of novel shape, that is mounted by ball and socket joint on the supporting shaft, which connects and binds directly the four rods of the outrigging, in connection with one screw nut.

IMPROVED GAS REGULATOR AND PURIFIER.

Eli T. Booth and Daniel J. Esser, Mauch Chunk, Pa.—The invention consists in using gasoline and charcoal in the purification of gas by arranging it between perforated plates, one of which is over the space wherein the gas enters, and the other just under the space wherein the purified gas is collected before use.

IMPROVED SIGNAL HEAD LIGHT FOR LOCOMOTIVES.

John V. Slusser, Louisville, Ky.—This inventor proposes to combine the signal lights with the head lamp of the locomotive, so that they receive their light from the burner of the head lamp. The invention consists in the arrangement of one or more short tubes applied to the head light of a locomotive, said tubes to be fitted with movable caps with colored glass for signals. The engineer can thus at any time, on receiving orders on the road, change without delay the solid caps which cover the lamps to transparent glass ones, which give the signals without having the trouble to light the signal lamps now in use.

IMPROVED FUR-CUTTING KNIFE.

William F. Hoffman, Brooklyn, N. Y.—This consists of a gang of knife blades, fixed at suitable distance apart in a frame, to which they are pivoted at the end of the shank. Between pivots they are fixed adjustably on a clamp screw, so that the blades can be readily adjusted to set the points all in the same plane from time to time, as they wear away irregularly. The cutter is designed for cutting the fur into narrow strips for trimming and the like, which is now done with one blade only.

IMPROVED METHOD OF MANUFACTURING FLOATS.

Linn B. Benton, Milwaukee, Wis.—This is a float made of spun hemispheres forced on a beveled connecting band, and soldered at the joint with a galvanic copper solution.

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Business and Personal.

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Swimming Shoes—Pat'd Nov. 2, 1875. Will sell Patent, or have them made on royalty. O. G. Ahlstrom, 104 Center St., New York.

Wanted—A good 2d hand Steam Engine, Cylinder 18 in.x36 in.; Band Wheel, 12 or 13 ft.x26 in. face. Address, with full particulars, N. W. Robinson, P. O. Box 775, Burlington, Vt.

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Meter and Yard Comparing Rods, Meter Sticks, and Meter Scales of every description, at Keuffel & Esser's, 111 Fulton St., New York.

Wanted—2d hand 20 to 24 in. Swing Lathe, Bed 12 ft.; Screw-Cutting; good order. Address S. J. Benedict. East Randolph, N. Y.

Wanted—Position to build intricate experimental machinery, or charge in general machine shop, by a driving man. Address C. F. B., 280 Henry St., Brooklyn.

Parties about to build, write Pugsley, 6 Gold St., N.Y., for price Wheelbarrows, Picks, Shovels, Sandscreens.

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For Sale—36 in.x16½ ft. Lathe, $400; 25 in.x12 ft. Lathe & Chuck, 390; 18 in.x12 ft. Lathe, $250; 15 in.x8 ft. Lathe & Chuck, $175; Fox Lathe, $200; 8½ ft. Planer, $425. Shearman, 45 Cortlandt Street, New York.

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Inlaying and Fret Sawing in Wood, Shell, Metal, &c. See Fleetwood Scroll Saw, page 188.

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N.Y.

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American Metaline Co., 61 Warren St., N.Y. City.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

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Diamond Tools—J. Dickinson, 64 Nassau St., N.Y.

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Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

All Fruit-can Tools, Ferracute W'ks, Bridgeton, N.J.

Notes & Queries

C. M. will find a recipe for filling for wood on p. 315, vol. 30.—J. E. M. will find a recipe for chicken cholera medicine on p. 395, vol. 30.—A. G. will find a good recipe for mucilage on p. 196, vol. 34.—H. C. S. can bronze castings by the method described on p. 11, vol. 34.—A. B. R.'s discovery of an electric phenomenon is similar to A. S. G.'s, explained on p. 186, vol. 34.—W. L. D. will find directions for repairing the silvering of his mirror on p. 267, vol. 31.—R. S. can coat cellular substances with silver by the process described on p. 203, vol. 34.—P. & L. cannot use the electricity from a belt economically. See p. 10, vol. 34.—J. C. C. will find on p. 203, vol. 34, particulars as to molding wax for electrotyper's use.—T. E. L. will find directions for staining wood in imitation of mahogany on p. 170, vol. 34.—C. W. K. will find a full description of Dr. Crookes' torsion balance on p. 149, vol. 34.—E. B. and others will find full directions for making an æolian harp on p. 315, vol. 33.—A. A. H. will find directions for making a battery for medical purposes on p. 196, vol. 27.—T. H. H. can utilize mica scraps by the method described on p. 42, vol. 25.—W. F. S. will find a description of an incubator in a forthcoming number.—J. L. R. Jr., will find on p. 42, vol. 26, directions for fastening leather covers to iron pulleys.—W. W. N. will find on p. 202, vol. 30, directions for painting tin roofs.—R. J. O'C. can fasten rubber covers to wooden spindles with good glue.—O. B. F. will find directions for amalgamating zincs for batteries on p. 27, vol. 30.—J. M. will find that timber will bend more easily if kept for some time in boiling water.—J. T. S. will find a description of malleable cast iron on p. 138, vol. 29.—H. E. will find directions for making artificial stone on p. 113, vol. 24.—J. P. will find directions for making citrate of magnesia on p. 203, vol. 34.—E. C. B. will find a practical recipe for tinning iron castings on p. 362, vol. 31.—R. C. M. will find directions for soldering gold on p. 251, vol. 28.—T. P. F. will find formulas for calculating the strength of boilers on p. 186, vol. 32.—W. T. D. will find directions for bluing steel on p. 123, vol. 31.—J. E. M. will find directions for preserving natural flowers on p. 204, vol. 28.—J. J. will find directions for putting a white enameled surface on iron vessels on p. 362, vol. 32.—C. H. R. will find directions for melting rubber on p. 119, vol. 28.—J. W. B. will find directions for browning gun barrels on p. 11, vol. 32.—H. C. S. will find directions for electro-silvering on p. 362, vol. 31.—E. D. will find a description of the sand blast process, which is patented, on p. 195, vol. 27.—L. L. F. will find a description of the gyroscope, on which the toy which he describes is founded, on p. 91, vol. 31.—C. R. will find directions for utilizing leather shavings on p. 105, vol. 25.—A. P. will find directions for varnishing violins on p. 281, vol. 26.—A. L. S. can run solder into thin bars by the method described on p. 282, vol. 31.—W. C. W. will find a description of testing lubricating oils on p. 360, vol. 33.—J. W. V. will find directions for lighting gas by electricity on p. 4, vol. 29.—J. A. will find a good recipe for stove polish on p. 169, vol. 33.—F. G. P. will find an explanation of the theory of color on p. 180, vol. 33.—A. B. can blacken the inside of brass telescope tubes by the method described on p. 362, vol. 25.—J. O. will find on p. 27, vol. 34, directions for making mucilage for postage stamps.—J. P. J. will find directions for making battery carbons on p. 187, vol. 32.—T. H. R. can ascertain the amount of moisture in the air by using a hygrometer. See p. 409, vol. 32.—W. S. can season his wooden hubs by the process described on p. 58, vol. 32.—G. W. S. will find a recipe for cement for rubber on p. 119, vol. 28.—H. E. J. must use Indian and Chinese ink for Patent Office drawings.—W. W. will find, on reference, that the absolute zero of temperature, and the shrinkage of gases when cooled, are discussed on p. 170, vol. 32.—J, W. J. will find a recipe for stencil ink on p. 273, vol. 28.—C. H. C. will find directions for calculating the speed of pulleys, etc., on pp. 26, 73, vol. 25.—G. B. F., C. E. C., K. Q. X., and J. A. have sent correct answers to W. C. S.'s problem published on p. 107, vol. 34. The replies sent by S. R., M. A. C., and C. F. E. are erroneous.

(1) G. D. T. asks: 1. What is the actual horse power of a steam engine 10 x 14 inches, running at 215 revolutions per minute, with a boiler pressure of 60 lbs., cutting off at ⅕? A. A test would be necessary before this question could be answered. 2. Can the exhaust steam pipe on an engine be turned into the smoke stack without injury to either? A. Introduce the exhaust pipe so that it discharges upward, in the middle of the smoke stack.

(2) F. E. H. says: Please give me a recipe for making Pharoah's serpents. A. The genuine ones are simply sulpho-cyanide of mercury made up by means of gum water into the form of cones, pills, or cylinders. They are still made and sold, on a small scale, in this city. We are not aware of any law specifically referring to them. Several substitutes for the dangerous mercury preparation have been proposed, but the snakes they produce are not so life-like nor so big. The following is said to be the best imitation: Take white sugar 3 parts, bichromate of potash 2 parts, saltpeter 1 part. Pulverize separately and mix intimately; finally press the mixture into small paper cones.

(3) E. L. S. asks: What diameter and pitch of propeller would you advise for a boat 58 feet long, 7½ feet beam, with 3½ feet draft of water, engines having 6 x 8 inches cylinders? A. Diameter 3½ feet, pitch 4½ to 5 feet.

(4) R. S. B. asks: I have some liquid which is neither good old hard cider, for it has a vinous taste, nor yet is it good vinegar. How can I convert it into good marketable vinegar? A. Prepare a large barrel, with a false bottom having a number of holes bored through it. Place this in the barrel about six inches above the real bottom, and fill in above the false bottom to the top of the barrel with good, well burnt charcoal, in coarse powder. Moisten the charcoal thoroughly with some of the cider, cover the barrel with a piece of felt or woolen goods, and allow to remain until there is a perceptible rise in the temperature; then add the cider in such a manner as to keep up a constant percolation of the fluid through the charcoal until the process is complete. The vinegar may be drawn off from a spigot at the bottom.

(5) R. J. C. asks: How much power is there in an overshot wheel propelled by a spout of water 12 inches wide by 3 inches deep? A. A good overshot wheel may give ¾ of the whole effect of the water.

(6) F. O. says: P. is testing a boiler with water from a pipe showing a pressure of 60 lbs. The boiler being filled, the gage shows 5 lbs. The gage is half way from top of boiler: now, if the pressure be added from the pipe, should the gage on the boiler show 60 or 65 lbs.? I claim the cause of the 5 lbs. pressure is due to the weight of water above the gage, and must be added to the 60 lbs., and make the gage say 65. P. says the 6 lbs. has nothing to do with it; the pressure must be 60 lbs. Who is right? A. If the pipe enters the boiler at the lowest point, according to the data furnished, the pressure at the highest point of the boiler would be 60 lbs., and the gage would show a pressure of 65 lbs.

(7) C. G. N. asks: How large a boat will a 3 horse power engine propel, with side wheels? A. Make her from 20 to 25 feet long. Good friction gearing is preferable to ordinary toothed wheels. Side wheels give very satisfactory results in smooth water.

(8) R. B. H. L. asks: 1. What kind of cannon is used for chain shot? A. Chain shot have ordinarily been fired from a smooth-bored gun; but we believe that occasionally a peculiar form of gun has been employed, consisting of two barrels, slightly diverging at the muzzles and having a common vent. 2. How many kinds of cannon have ever been used? A. Cannons are generally classed as muzzle and breechloaders, with smooth bore or rifled barrels. 3. If a cannon 1 inch bore, 70 feet from a target, be loaded with 100 No. 1 shot, to what width would the shot spread? A. It is impossible to give a definite answer to this question, since, as you must be aware, the difference in the performance of different guns, in this respect, is very marked.

(9) T. D. and others.—There is no work on taking the buckle out of saws. It is an art known only to saw makers, and attainable only by long practice and a thorough knowledge of the principle upon which saw plates are worked in order to impart that strain upon different parts so as to overcome the expansion by centrifugal force caused by the velocity of the saws in use.—J. E. E., of Pa.

(10) D. W. W. asks: 1. Is it possible for boiler tubes to get heated to the point of producing a spheroidal state when the proper supply of water is kept up in the boiler? A. Experiments seem to show that, in order that water may assume the spheroidal state, a small quantity must be dropped upon a plate which is heated to a higher temperature than the boiling point of the water. 2. What is the lowest temperature at which the spheroidal state can exist in the case of iron and water, and how is it affected by pressure? A. Under atmospheric pressure, the temperature required is about 290° Fah. In a boiler properly designed, the temperature necessary for the spheroidal state could not be produced, if the ordinary water level was maintained. We have, however, occasionally seen boilers in which the circulation was so poor that tubes were burned out when apparently covered with water.

(11) W. C. B. asks: 1. Is it practicable to pump water through a pipe 150 feet long, it being level from the pump to the well, which is 18 feet deep? Yes. 2. Is it better to have the pipe higher at the well than the pump? A. Lay the pipe as straight as possible, with the highest point at the pump. 3. Should there be a check valve at the well? Yes. Put it at the bottom. 4. What sized pipe should we use? A. A 2 inch pipe.

(12) S. H. S. asks: What is the matter with our stove? When the damper was closed, the draft went around under the bottom of the stove; when the draft is all closed, the smoke or something else will condense into liquid and run through the chimney, through the upper floors, and into the room below. A. This may be owing to some peculiar kind of fuel you are burning, which you do not specify. When the draft is closed the flue soon becomes cold, and the air carrying the smoke precipitates its latent moisture upon the sides of the flue; the moisture naturally carries the particles of unburnt fuel with it. If this is the cause, a more free draft would abate the difficulty.

(13) M. B. says: I have a boat 50 feet long and 10 feet wide. The engine is 8 x 9 inches. What size and pitch of wheel should I use? A. You can use a wheel 3½ feet in diameter, with 5 feet pitch. In general, a wheel that is properly proportioned for speed is likewise suitable for towing.

(14) J. J. says: It is claimed that the outside horse, in plowing a circle, commencing in the center, gains only so much as he gains in the first round and no more, as the inside horse follows all the time after. Others assert that the outside horse gains each round plowed, and will gain in each round so long as they continue plowing in a circle, and that each and every day the outside horse has traveled the farthest. Which is right? A. This is a very pretty question, of little or no practical importance; and we therefore forego the satisfaction of answering it, and throw it open to the competition of those who may be interested in finding a solution.

(15) M. J. asks: What is the method of testing hydraulic cement for water? A. It consists in gaging a small quantity of the dry powder with water, and immediately immersing it in water. If the sharper edges crack or break away after a short time, the cement is too hot or fresh, or is inferior in quality.

(16) J. H. D. asks: What weight can an average horse raise, if hitched to a rope, the rope to pass over a pulley, and the weight attached below? A. The following table, given by Mr. Trautwine, furnishes a fair statement of average results, the speed of horse being miles per hour, and the traction in lbs.:

Speed.	Traction.	Speed.	Traction.
¾	333	2¼	111
1	250	2½	100
1¼	300	2¾	91
1½	167	3	83
1¾	143	3½	71
2	125	4	63

(17) J. A. K. asks: What causes an explosion when water is pumped into a hot boiler? Is it the sudden generation of steam, or does the boiler crack? A. When an explosion takes place under such circumstances, steam is formed rapidly; and the iron, weakened by overheating, cannot resist the pressure.

(18) J. W. A. McC. asks: By what rule can I find out what quantity of water will be supplied by a wooden pipe, with a 3 inch bore, having a head of water of 250 feet, the length of said pipe being about 10 miles? A. If we knew all the particulars of the case, we could only give you approximate rules; and it would be useless to attempt to furnish information from the meagre data you have sent. We hope to treat of matters of this kind, in special articles, before long.

(19) R. E. B. says: If I take out a water wheel 10 feet in diameter, and replace it with one 2 feet in diameter, using the same quantity of water, do I gain any power? A. Not from the fact of its being larger. If the new wheel is a better one than the other, *per se*, there will, of course, be a gain.

(20) T. A. B. asks: Should the balance wheel of a gig saw or vertical re-sawing machine and the gate and connecting rod of the same form a perfect balance, to prevent thump or jar? A. Vertical resawing or other rapidly operating machinery should be balanced so as not only to counteract the weight of the gate or frame and connecting rod, but also the momentous force, and this latter depends upon the velocity at which it is run. I know of no established rule for accomplishing this. About the only way that I know of to get a perfect counteraction is to construct the balance wheel with more counteracting weight than is really required. Then remove the surplus little by little until the machine moves properly.—J. E. E., of Pa

(21) W. M. K. asks: To what extent, if any, will air in an open inverted vessel, mingle and pass off with a current of water when deeply immersed and under a pressure of 500 lbs. to the square foot? Would hydrogen or some other gas remain longer unchanged in bulk than atmospheric air? A. Either the air or hydrogen will be absorbed much more readily by the water, under these circumstances, than under ordinary pressure.

(22) G. H. says: I have in my cellar a horizontal single flue boiler for the generation of steam for heating purposes. Trouble seems to be caused by a sluggish combustion. It does not smoke nor emit gas; but no matter how much coal is put in at one time, the fire burns dull, and it is difficult to raise 3 lbs. of steam and hold it. The flue fills with soot quickly, which hangs in festoons, indicating that there is no draft. A. Your description will not enable us to help you very intelligently; but we would recommend that you see whether the chimney, *per se*, is in good working order.

(23) H. F. J.—We cannot estimate the performance of your engine and boiler accurately from the data sent. If you will put a check valve on the end of your pipe, we think you will have no more trouble.

(24) O. K. and others ask: 1. How is the focal length of a microscope lens calculated? A. Focal length is reckoned from the center of the combination. 2. How can I test lenses for chromatic faults? A. The only test for achromatism is the color; if there is no color, the lens is achromatic. The best lenses are made of two kinds of glass cemented together and burnished in the cell, there being no necessity for removing them. 3. How can I ascertain and compare the powers of microscopes? A. In comparing the magnifying power of microscopes, opticians generally have agreed to consider 10 inches as the distance of distinct vision; then by comparing the real size of the object with the apparent size of the image at a distance of 10 inches, the magnifying power is easily determined. See p. 25, vol. 33.

(25) G. W. S. asks: What should I put on a wooden plug joint to harden the wood (poplar, bass, or lime) and at the same time to keep the joint from moving when fastened in by a screw at right angles to the plug? A. Powdered resin might answer your purpose.

(26) G. W. J. says: 1. I am running a pair of high pressure engines, 15 x 28 inches, with 100 lbs. steam, at 150 revolutions per minute. These engines are both connected to the same shaft, with a fly wheel only 3 feet in diameter but very heavy. On the crank shaft is a cog wheel 2 feet in diameter, geared in another wheel on a countershaft, 5 feet in diameter, or 2½ to one. Connected to this countershaft is a screw 10 inches in diameter, with square thread of 1¼ inch pitch, or 9½ threads to the foot, running through a cast iron nut. How much thrusting pressure do we apply to that nut?

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A. The greatest pressure on the nut will be between 9 and 10 times the maximum pressure on the crank pins. 2. Would a cast steel nut work better and cooler than a cast iron or gun metal one? A. With sufficient bearing surface, we think you will find cast iron a satisfactory material for the nut.

(27) W. H. asks: Is there any rule for the weight of green pine timber? What is the difference in weight between green timber and dry timber? A. It would be impossible to answer these questions very exactly, without experimenting in each special case. Dry white pine weighs about 25 lbs. per cubic foot, and green pine from 30 to 37.

(28) J. B. K. asks: 1. Which is the best for a base to plate on (for such articles as spoons and forks), nickel silver, white metal, or albata? A. All these alloys are good for the purpose. 2. Of what metals are these different bases composed? A. Nickel silver is a variety of German silver, of which many kinds are in use. The following is a good one for plating on: Copper 55, nickel 24, zinc 10, tin 3, and iron 2 parts. White metal consists of: Tin 82, lead 18, antimony 5, zinc 1, and copper 4 parts. Albata is another name for German silver.

(29) W. H. E. asks: What should be the number of revolutions per minute of a screw propeller in a model 3 feet 6 inches long, to gain the maximum speed? A. The question is too indefinite. Probably you could not get a correct solution in any way but by experiment.

(30) W. G. M. says: 1. I have become near-sighted, my eyes being in different degrees affected. I can see to read well at the common reading distance, which does not seem to be the case with others I have noticed similarly afflicted. What has caused it, lamplight or too constantly looking at near objects? A. The natural eye has the power to cause the front of the crystalline lens to become more or less convex as objects looked at are nearer or farther from it. In your case that power appears to be lost by over exertion in looking at near objects. 2. Can my sight be restored? A. Probably it can, with proper care and rest. 3. In looking at distant objects I am compelled to partly close my eyes, when the objects become far more distinct. Why is this? A. In closing the eye, the light passes only through the central portion of the lens, and this part is of longer focus. 4. Will the use of glasses strengthen the eyes, or cause a growing necessity for them? A. If used constantly they will not be likely to remedy the defect. 5. Would their use have a tendency to make both eyes alike? A. Probably not. 6. Should they be worn continually? A. No.

(31) G. C. asks: Is the steamer Great Eastern constructed so as to be divided in any number of parts, each part to sail independently on entering a small harbor or in case of a rough sea? A. If it ever was constructed in this manner, the matter was kept a profound secret.

(32) J. P. W. says: In *Science Record* for 1874, on p. 574, are directions for making a portable field camera obscura. I have followed the directions, but it will not work, as the lens will not throw the image downward. A. The difficulty probably is that the lens is not long enough in focus. The distance from the center of the lens to the mirror and thence to the paper should be the focal length of the lens. It will not be practicable to use a lens of a shorter focus than 2 feet.

(33) C. K. asks: 1. Will a good achromatic object glass of 2 inches diameter and 3 inches focus, with an eye lens of ½ inch focus, make a telescope strong enough to see the phases of the planets Venus and Mercury? A. Yes. 2. Will it show the globular form of Jupiter and the ring of Saturn? A. Yes; with a steady atmosphere you should see the belts on Jupiter also.

(34) J. M. T. asks: 1. I wish to make a telescope. Which will be the cheapest, a reflecting or refracting telescope? A. In small telescopes there is not much difference. 2. What will an object glass, 2½ inches diameter, of 44 inches focus, cost me? A. About $20. 3. What power would it stand? A. A power of 150.

(35) C. R. says: It is desired to surround upright cylindrical stoves by shields to protect woodwork, etc., from the intense heat radiated. Can you suggest some simple and efficient form and material? There should be a door to permit the introduction of coal. A. Sheets of zinc will be the best, unless you require an ornamental effect. In the latter case, use Russian iron.

(36) J. M. G. says: A steamboat boiler is filled to top of steam chimney with water, and shows 5 lbs. pressure on the steam gage from weight of water in pipe connecting the gage with boiler. In testing the boiler to 60 lbs. water pressure, will it be necessary to show 65 lbs. on the gage in order to have 60 lbs. on the boiler? Will the gage show 5 lbs. more than a gage placed at the pressure pump? A. When there is a pressure of 60 lbs.; at the highest point of the boiler, under the circumstances stated, the gage will indicate 65 lbs., and the gage in pressure pump will indicate a still higher pressure, if, as is generally the case, it is subjected to the action of a still higher column of water.

(37) A. N. asks: How can I write or draw on smooth plates of zinc, and afterwards etch the marks in with acid? A. Mix 1 part strong nitric acid and 100 parts water: pour over the plate, and let it run to and fro. Wash with water, and pour weak gum water over the plate.

(38) X. X. X. asks: How can I make a good oleate of soda? A. Oleic acid forms two classes of salts, normal and acid. The normal salts of the alkalies are the only soluble ones. They form soaps, and by the evaporation of their aqueous solution may be obtained in the condition of an amorphous mass. The isolation of oleic acid in a state of purity is a matter of some difficulty, owing to its tendency to combine with oxygen. To obtain pure oleic acid, olive or almond oil is saponified with potash; the soap is decomposed by tartaric acid, and the separated fatty acid, after being washed, is heated for some hours in the water bath, with half its weight of lead oxide, previously reduced to a fine powder. The mixture is then well shaken up with about twice its bulk of ether, which dissolves the oleate of lead and leaves the stearate; the liquid after standing for some time is decanted and mixed with hydrochloric acid; the oleic acid thereby eliminated dissolves in the the ether, and the etherial solution, which rises to the surface of the water, is decanted, mixed with water, and freed from ether by heat The acid may now be converted into soap by the addition of pure caustic soda, which is afterwards separated from its aqueous solution by the addition of chloride of sodium, and pressed to remove excess of moisture. Owing to the strong affinity of the liquid acid for oxygen, as prepared by the above method, it has a brownish color and a slight odor. See answer to A. B. C., below.

(39) A. B. C. asks: Can oleate of soda be made chemically pure? A. If absolute purity be requisite, try the following: Redissolve the oleate of soda, as obtained by the above method, in water that has been boiled for some time to expel all the air, and again decompose with tartaric acid in vessels filled with carbonic acid gas. Allow the acid to settle, decant the supernatant liquid, and wash with water free from air. Then add a large excess of strong ammonia, and, when solution is complete, precipitate with chloride of barium. The oleate of baryta thus formed is dried and boiled with alcohol. During this operation the salt melts and forms a viscous liquid, but a portion of it is dissolved, and is deposited in crystalline plates as the liquid cools; these are again crystallized from alcohol, and on decomposing them with tartaric acid pure oleic acid is obtained.

(40) W. S. D. says: 1. A church is being heated by a hot air furnace, but there is a fault in the ventilation, which is effected by one large pane in each window hanging on a swivel. When the church cools, there is a cold damp air, and the furnace draws cold air from the inside of the church. A. The supply of fresh air to the furnace should be taken from the exterior of the building, by means of an enclosed shaft, which may be constructed of matched boards for the most part, being of brick near the furnace. Place a valve, or shutter on pivots, within the shaft, to close it when required. Additional openings for ventilation should be provided at the ceiling.

(41) J. F. B. asks: 1. Is it necessary that the wires of a galvanic battery be copper, or will iron wire do? A. Not absolutely necessary; but as the conductivity of copper is about seven times greater than that of iron, it is better to use copper. 2. Is the vapor of a battery, consisting of copper zinc plates, poisonous? A. No.

(42) X. Y. Z. asks: 1. How is an ohm, in electricity, measured? A. An ohm, the unit of electrical resistance, is roughly equivalent to 1 foot 1·9 inches in length of German silver wire of No. 29 British Association gage. It would not do, however, to place much dependence on its accuracy as thus determined, as the resistances of various samples of wire vary considerably. Standard copies of the ohm are supplied by various foreign manufacturers of telegraph apparatus, and possibly, also, by some American houses. 2. How are the connections made in the open circuit system of telegraphy? A. The key is provided with both front and back contact points. At terminal stations the line is connected to the key lever; one pole of the battery and the back contact point are connected to earth, and the opposite pole of the battery to the front contact of the key. Except when the station is transmitting, the lever is allowed to remain constantly on the back contact.

(43) B. S. S. asks: 1. How long will a silver solution hold its strength? A. The cyanide solution should last for months if kept, as much as possible, from the action of air. 2. Ought it be bottled when not in use? A. Yes.

(44) C. R. asks: The quality of the magnet is destroyed by fire. Does this magnetic property of the iron impart itself to the fire? If not, what becomes of the magnetic property? A. The attractive property of a magnet is supposed to depend upon a peculiar arrangement of the molecules of which it is composed. Bodies capable of becoming magnetic offer more or less resistance to an arrangement of this kind. We may, therefore, assume that the molecules of a magnetic substance are in a state of strain. Heat reduces the conditions of restraint by imparting motion to the molecules, and thus allows them to resume their former position.

(45) C. A. H. asks: How can I make an electrical machine capable of giving the same power as a Bunsen battery? A. The ordinary electrical machine is not capable of producing a current equal to that from a Bunsen battery. A stick of shellac rubbed with flannel, however, will produce a greater tension, but the current from such a source is infinitesimal. A magneto-electric machine would cost more than the battery.

(46) W. R. asks: 1. What are the best width and thickness of single steel horseshoe magnets that will do to form a compound one? A. Make the width about $\frac{1}{20}$ of the length, and the thickness ¼ the width. 2. Of what size should single electro-magnets be to form a compound one? A. An electro-magnet, such as used for the sounders or registers in telegraph offices, will be found sufficient. 3. How shall I temper the magnets? A. For permanent magnets use the best, fine grained steel; temper as high as possible, and then draw, by heat, to a violet straw color. 4. How many feet of wire are required to saturate single bar magnets to form a compound 10 or 12 inches long? A. An electro-magnet, charged by two or three Daniell cells, will answer the purpose.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

L. L.—It is possible that the mineral was eucairite, with which it agrees in physical character; but the amount did not suffice to determine its chemical constitution. Will you send about 8 grains of the mineral, free from the gangue?—H. M. W.—The scale consists chiefly of carbonate of lime and sesquioxide of iron. The color does not indicate anything injurious.—L. C. T.—Send us a specimen of your mineral, and we will tell you what it is.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Car Brake. By M. M. S.
On Problems in Gunnery, etc. By R. H.
On a Cannon Musical Instrument. By H. M. B.
On Belting. By E. H. D.
On a Geometrical Problem. By J. D. L.
On the Mississippi Improvements. By B. J. B., and by O. P. S.
On the Moon. By J. A. S.
On Employers and Employees. By O. O. T. E.
On a Solar Phenomenon. By J. C.
On Another Explosion. By H. I. F.
On Transplanting Trees. By C. E. H.

Also inquiries and answers from the following:

C. A. W.—R. F. F.—D. L. W.—J. L. R. B.—F. W.—W. R.—C. D.—S. H.—A. F.—W. C. I.—E. W.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells machines for recutting hand saws? Who sells pure bred poultry? Who makes brass castings? Who makes cider mills that grind and press at one operation? Whose is the best boiler for generating steam to heat water in a tank? Who sells platinum, and what is its cost? Who sells machinery for working small screw propellers by hand power?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 29, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Alarm, electric burglar, W. H. Rodgers 174,156
Alarm, electric fire, W. Gates 174,070
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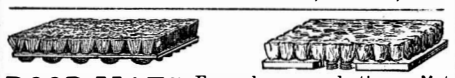

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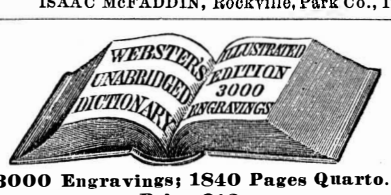

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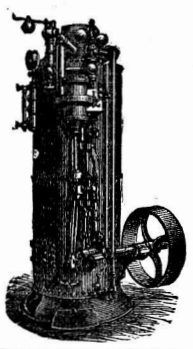

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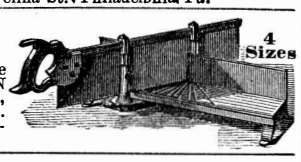

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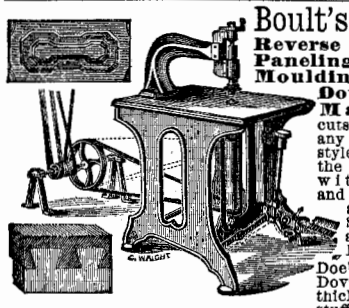

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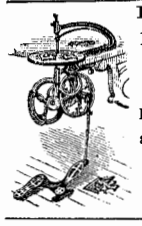

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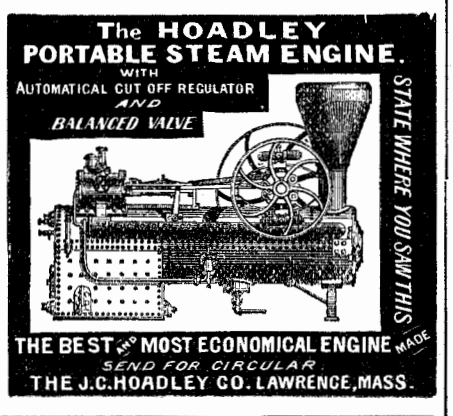

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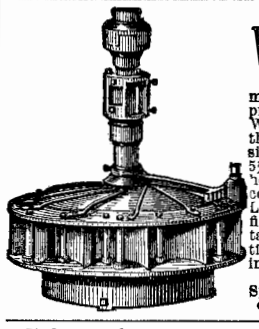

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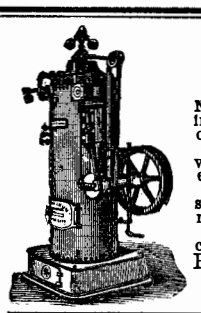

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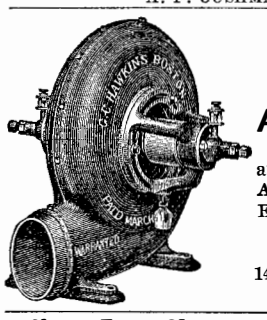

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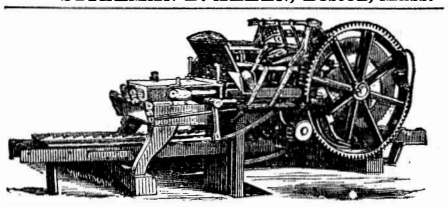

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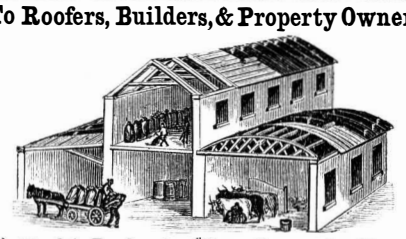

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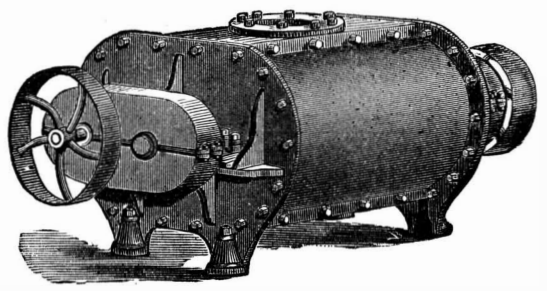

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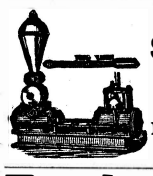

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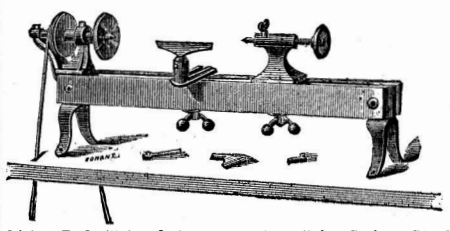

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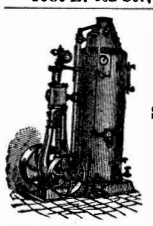

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